

Presents
to B.S. Dhawan

B.S. Dhawan
21/3/73

FIRST ASIAN CONGRESS OF NUTRITION



SYMPOSIA

ABSTRACTS

SPECIAL REPORTS

RESEARCH COMMUNICATIONS

JANUARY 28 — FEBRUARY 2, 1971

HYDERABAD

INDIA

184

**FIRST
ASIAN CONGRESS
OF
NUTRITION**

SYMPOSIA

ABSTRACTS

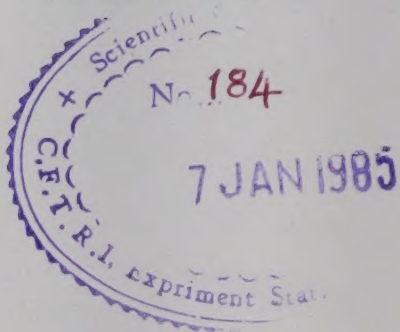
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SYMPOSIA

1. THE PRESENT PATTERN OF PRODUCTION AND AVAILABILITY OF FOODS IN ASIA

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FAO, Rome, Italy.*

The present pattern of food production in the region is dominated by cereals, rice in particular. Cereals provide some 70% of the calories and 60% of the protein in the diet. Next in importance are pulses which, together with nuts, contribute 20% of the protein. Only about 15% of the total protein comes from animal products. Milk is a primary source of animal protein in S. Asia; elsewhere it is fish while in Eastern Asia meat and eggs are taken in substantial quantities. Fruits and vegetables are only important for their contribution to vitamin and minerals. Fats provide only about 5% of the calories.

The trend of imports of cereals and milk is increasing over the years, progressively adding to the availability of food for consumption from domestic sources. Still, calorie supply is short of nutrition requirements in all sub-regions, except in Eastern Asia. Protein supply is about adequate in the aggregate but it is very unevenly distributed among households. It is estimated that as much as one third of the population suffer from protein malnutrition. However, in only about one out of ten cases does protein deficiency appear to occur as a direct result of inadequate intake of total energy. The protein available in the cereal-pulse based diet is practically adequate provided man takes enough food to meet his energy needs. Milk and eggs are however important for the other nutrients, particularly vitamin A, iron and calcium and have also a vital role to play in the post-weaning phase of children for ensuring a smooth transition from breast milk to solid diets without impairing the digestive capacity of their stomachs.

Inadequate income of a large section of the people is the principle explanatory cause of the high incidence of undernutrition and malnutrition. The growing unemployment and scarcity of arable land threaten to aggravate the situation. The high yielding varieties have however opened up new possibilities for higher crop yield and multiple cropping which provide a unique opportunity of the countries of the region for raising the level of living of all, even the small farmers.

2. RECENT DEVELOPMENTS AND FUTURE POSSIBILITIES IN FOOD GRAIN PRODUCTION IN ASIA

D. S. Athwal,

*International Rice Research Institute,
Manila, Philippines.*

Cereal grains supply 67 per cent of the food calorie intake and about 60 per cent of the protein intake by Asians. Rice and wheat are the principle food grains. Their yields in most Asian countries are extremely low. Fertilizer is the key factor in increasing crop production. The traditional tall growing varieties did not respond to fertilizer efficiently. Attempts to breed fertilizer-responsive varieties were generally unsuccessful until plant breeders discovered the Chinese rice Dee-geo-woo-gen and Japanese wheat Nortin 10 and used them in breeding programmes. The development of semi-dwarf varieties led to an unprecedented flow of their seed from Mexico and the Philippines to many Asian countries and to rapid spread of new seed in a short time. During 1969-70, the dwarf wheat and rice were grown on 17 million hectares which resulted in greatly increased production. The Philippines attained self-sufficiency in rice and Pakistan, self-sufficiency in wheat. Production of wheat in India and of rice in West Pakistan almost doubled during the last 5 years.

The potential exists to double or even triple production during the next 3 decades by using high yielding varieties and other agricultural inputs and by multiple cropping. But intensive research is needed to develop disease and insect-resistant strains and heavy investment is required for fertilizer production and for the development of marketing, transportation and storage facilities. In spite of the potential for higher rice and wheat production, the food problem can be effectively solved only if attempts at increasing food supplies are accompanied by population control measures.

3. GENETIC UPGRADING OF NUTRITIVE QUALITY IN FOOD PLANTS

M. S. Swaminathan,
Indian Agricultural Research Institute,
New Delhi, India.

The important staples of India like rice, *Sorghum*, wheat, various millets like *Pennisetum typhoides*, *Eleusine corocona* and *Panicum*, *Paspalum* and *Setaria* species and tapioca have either a low protein content or a protein of low PER. It has been known for many years that both the protein and starch characteristics of crops like maize and rice can be altered genetically. A further dimension to the genetic approach to improving quality was opened up in 1964 with the discovery made in Purdue University, U. S. A., that maize containing the opaque-2 gene has a high lysine content. This discovery marked the beginning of an extensive search for plant genotypes with better protein and nutritive qualities. Besides maize, striking successes in identifying high protein or high lysine strains have been achieved so far only in barley and tapioca.

A strategy for breeding strains rich in protein and nutritive qualities will have to be developed for each crop. Thus, in crops like wheat, rice, potato and tapioca, the enhancement of protein content *per se* can be the primary aim since increased protein content does not lead to a reduction in the quantity of lysine upto a certain point. In maize and *Sorghum*, a reduction in the prolamin fraction of protein helps to increase lysine and tryptophan content and improve the lysine-leucine balance. In Pearl Millet (*Pennisetum Typhoides*), the prolamin fraction is poor in lysine but rich in tryptophan. Hence, an improvement in lysine content has to be achieved without diminishing the tryptophan content. In other millets, the digestibility of protein can be increased if the fibre content in the seed is reduced. In pulses, methionine content needs improvement. For achieving these aims, reliable and non-destructive methods

of mass screening of segregating populations have been developed.

Cooperative research now underway at the Indian Agricultural Research Institute, New Delhi and the National Institute of Nutrition, Hyderabad indicates that high-yielding cum high quality varieties can be developed soon in several of the important crop plants. The following are the major aims of this research :

- (a) Development of high-yielding varieties of wheat, rice, barley, maize, *Sorghum* and millets which have both high and better protein.
- (b) Development of high yielding strains of pulses with a higher methionine content
- (c) Breeding of high protein fodder crops and
- (d) Development of new protein sources like *Triticale* and Gossypol-free cotton. Composite varieties of maize containing high lysine have already been developed and kits containing seeds of nutritionally superior strains will be popularised.

4. THE AUGMENTATION OF ANIMAL PROTEIN FOOD RESOURCES IN ASIA

K. L. Blaxter,
*Rowett Research Institute,
Bucksburn, Aberdeen, U. K.*

The distribution of domesticated animals in Asian countries is considered and the estimates of their productivity compared with estimates made for animals in Western Europe and N. America. The socio-religious restraints on livestock industries, the effects of established dietary habits on demands for animal products, the continuing role of animals as sources of motive power and the problems of distribution, processing and storage of animal products for food are commented on as they affect development programmes. The importance of animals as converters of crop and other inedible wastes to human food is dealt with in some detail and emphasis is given to the general importance of increasing output of livestock for food from the small farm by expansions of local husbandry practices. In these situations cattle and buffalo may be less attractive in the initial stages than are goats, poultry and pigs. Alternative larger scale systems involving a high degree of intensification are also discussed. The importance of continuing education and advice, the provision of credit and of an adequate marketing organisation are emphasised.

5. EXPLOITATION OF MARINE FOOD
RESOURCES IN ASIA

M. K. Pannikar,
*National Institute of oceanography (C.S.I.R.),
Panaji, Goa, India.*

6. RECENT METABOLIC STUDIES ON VITAMIN 'D'

H. F. DeLuca and T. Suda,
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U. S. A.*

Vitamin D₃ either from the diet or from the skin after U. V. irradiation, is inactive on the target tissues of bone and intestine but is converted to the 25-hydroxy derivative (25-HCC) in the liver. The conversion which is an O₂, TPNH requiring system is strongly product-inhibited by 25-HCC. This inhibition controls the rate of formation and "secretion" of 25-HCC in to the blood. The 25-HCC markedly increases mobilization of bone in culture and calcium transport in isolated intestine while vitamin D₃ itself does not. In intestine and bone, the 25-HCC is converted rapidly to two additional metabolites. Either 25-HCC or its further metabolite(s) acts in the nuclei to unmask a specific section of DNA which codes for a calcium transport component. This component makes its appearance in the intestine as a calcium-ATPase of the microvilli and/or calcium binding protein where it functions to facilitate calcium transport.

7. STUDIES ON FOLIC ACID

A. T. Batu,

*Burma Medical Research Institute,
Zafar Shah Road,
Rangoon, Burma.*

The results are given of blood folate measurements among anaemic and non-anaemic industrial workers and villagers from Burma.

In another study the effect of iron deficiency on folate nutritional status is studied. The data presented indicate that iron deficiency does not have a deleterious effect on folate nutrition. The interrelated effects of iron and folate deficiency are discussed.

Preliminary data from experiments using tritiated folic acid is presented confirming that folate remains locked in red cells till the end of their life-span.

8. ABSORPTION AND METABOLISM OF
RETINOIC ACID

J. Ganguly,
*Indian Institute of Science,
Bangalore, India.*

Retinoic acid was first synthesized by Van Dorp and Arens, who found it to be active in supporting growth of Vitamin A deficient rats. But on feeding large amounts of it they found no traces of retinol, retinal or retinoic acid in the tissues of rats. Since then it was widely accepted that retinoic acid is not absorbed by animals. However, during our work with vitamin A deficient rats we found that, following a single dose of 500 μ g. of retinoic acid, the deficient rats continued to grow for about 4 weeks. This was immediately followed by our observation that the appearance of retinoic acid can be demonstrated in the tissues of rats within 6 hours of giving a large dose of the acid; but no traces of it could be found in the rats at later time intervals. Finally, by establishing lymph and bile canulae in individual rats it was proved that retinoic acid is rapidly absorbed through the portal route and is quickly excreted through the bile.

It was also found that male and female rats raised on retinoic acid show reproductive failure. When the retinoic acid fed female rats are mated with normal males, they conceive, but resorb their foetuses on the 14th or 15th day of pregnancy. Injections of pregnenolone or 17 β -oestradiol, but not of progesterone, prevented such resorption. It was also shown that the ovaries of such rats do not develop properly and that the activity of the enzyme, $\Delta^5-3 \beta$ -ol steroid dehydrogenase, which converts pregnenolone to progesterone, is lower in the ovaries of the retinoic acid fed rats. Finally, it has been found that the secretion rates of progesterone and 20-hydroxy progesterone are markedly lower in the ovarian vein blood, during pregnancy, of the retinoic acid fed rats.

9. RECENT OBSERVATIONS ON ASSESSMENT OF THIAMINE AND RIBOFLAVIN STATUS

M. S. Bamji,

*National Institute of Nutrition,
Hyderabad, India.*

In a cross-sectional study, direct correlation between urinary excretion of thiamine, erythrocyte transketolase activity and clinical findings was not apparent. However, in a controlled longitudinal study on human volunteers, urinary thiamine and transketolase activity correlated well with dietary thiamine. *In vitro* addition of TPP failed to stimulate transketolase activity, after 2-3 weeks on a low thiamine diet.

Erythrocyte glutathione reductase activity and RBC and urinary riboflavin levels were studied in relation to riboflavin nutritional status. The enzyme activity as well as RBC-riboflavin levels were significantly lower in subjects with angular stomatitis and glossitis. Both the parameters improved after treatment with riboflavin.

In a controlled study on human volunteers, glutathione reductase activity and urinary riboflavin were found to be more sensitive than RBC-riboflavin to dietary vitamin.

Erythrocytes of subjects with riboflavin deficiency, and very low glutathione reductase activity showed satisfactory ability to maintain reduced glutathione levels in the presence of an oxidant drug like acetylphenylhydrazine. However, subjects with marginal deficiency showed slight impairment which got corrected after treatment with riboflavin. Presence of a compensatory mechanism in severely deficient cells is postulated. Deficient cells had normal G6PD activity and K_m of glutathione reductase for NADPH.

Some pregnant women with angular stomatitis and glossitis responded biochemically, but not clinically to riboflavin. Treatment with pyridoxine brought about good clinical response. These findings will be discussed in the light of biochemical inter-relationship between riboflavin and pyridoxine.

10. STUDIES ON RIBOFLAVIN

K. Yagi,

*Institute of Biochemistry,
Faculty of Medicine, University of Nagoya
Nagoya, Japan.*

Now-a-days, natural occurrence of ariboflavinosis is rather rare. However, it has been shown that some antibiotics such as chlortetracycline, which are in wide clinical use, provoke ariboflavinosis-like disease. Studies were made to understand the mechanism of this phenomenon, and the competition between chlortetracycline and flavin on both molecular and nutritional bases was observed.

The second topic is to introduce fat-soluble riboflavin derivatives such as riboflavin 2', 3', 4', 5', - tetrabutryate and riboflavin 2', 3', 4', 5', — tetranicotinate. To widen the application of riboflavin to the nutritional, biochemical and medical fields, fat-soluble derivatives of riboflavin, having intact isoalloxazine nucleus, were synthesized and studied in our laboratory. Specific advantages have been observed in administering riboflavin tetrabutryate in place of conventional riboflavin. Apart from having riboflavin activity, it has shown a storage tendency unlike its parent vitamin. This is because of its absorption directly through the intestines followed by its slow hydrolysis in the body tissues to riboflavin and butyric acid. The riboflavin part of the derivative when labelled was found to be incorporated in flavin mononucleotide and flavin adenine dinucleotide in the liver. The vitamin action of the tetranicotinate derivative was less marked than above. Nicotinic acid moieties have been found to be incorporated into nicotinamide adenine dinucleotide by isotopic experiments, and the vasodilator action of nicotinamide was prolonged due to slow release of this vitamin in the tissues.

11. PROBLEMS IN ORGANIZATION AND IMPLEMENTATION OF SCHOOL MEAL PROGRAMMES IN JAPAN

T. Oiso,

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Toyama-cho, Shinjuku-ku,
Tokyo, Japan.*

Although meals have been provided to children at school in Japan from a long time, this has always been undertaken as philanthropic work in each area and not on a national basis.

The present school lunch programme came into effect as a national policy after the War in an aim to elevate the physical status of school children which had considerably lowered during the war time. A special panel called the School Meal Panel was thus established under the Health and Physical Culture Council which acts as an advisory organization for the Minister of Education. The decisions reached by this panel are put into practice.

On the other hand, the School Meal Section was first set up in the Physical Culture Bureau of the Ministry of Education. The role of this Section is to review the school meal programme in detail and then give instructions and some subsidiary budgets to local governments to operate the project.

The elementary schools are looked after by the local authorities which are responsible for drawing out a concrete plan to actually manage this programme.

The framework of this project is that the school meal programme is left in the hands of each school so that the school principal assumes the responsibility, while the Parent-Teacher Association acts as a supporting organization to see that the programme is carried out smoothly. Under usual circumstances both the central government and local governments are expected to provide financial assistance towards this programme.

12. PROGRESS OF SCHOOL-FEEDING IN THE PHILIPPINES

Josefina Bulatao-Jayme,
*Food and Nutrition Research Centre,
Manila, Philippines.*

The policy for a national school lunch programme for all government elementary and secondary schools, first enunciated in 1952, was strengthened in 1967 with the addition of a distinct nutritional orientation. Its implementation was accelerated by the organization in 1964 of the applied nutrition programme in the country, the pilot project of which is being undertaken under the auspices of the Department (ministry) of Education. Improvement in nutritional status of school children four years after the start of the implementation of the programme is suggested by the biochemical data, but anthropometric data obtained from both experimental and control areas give equivocal findings. The overall evaluation of this UNICEF-assisted pilot project and some of its expansion areas is discussed.

13. CURRENT STATUS OF SCHOOL MEAL PROGRAMMES IN INDIA

Rajammal P. Devadas,
*Sri Avinashilingam Home Science College,
Coimbatore, India.*

Since 1925, various types of supplementary school feeding programmes have been in operation in different parts of India. In 1957, the Government of Madras came forward to assist donors to sponsor midday meal programmes in many centres of the state. Out of that collaboration with the public, the Tamil Nadu Midday Meal scheme was evolved. In this scheme, the cost of a meal is 10 paise per pupil. Out of which the Government of Tamil Nadu meets six paise, and the local donors contribute four paise. Today in Tamil Nadu alone, over 1.7 million children are receiving the free lunch in 33,000 primary schools.

During the year, the CARE came forward to help the Tamil Nadu Midday Meals Programme and other programmes in a large way. International agencies such as CASA-(Christian Agency for Social Action Relief and Development)-also give supplements to the meals programme. The ANP sponsored by the Government of India in collaboration with FAO-UNICEF-WHO helps the school meal programmes through the improvement of school gardens in the ANP Blocks. Today, the school lunch programme in some form or other or as milk distribution in operation in almost all the states, caters to over 13.1 million pupils in the age range 6-11 years. The fourth plan envisages the coverage to 15 million.

Apart from the numerous physical, social and economic benefits of the school meal programmes, it serves as an important medium for teaching nutrition. Through the school lunch, thousands of children get at least one meal a day.

Although the feeding programmes are planned with sound objectives, to which extent are the objectives fulfilled is a per-

inent question. There is no school lunch act in the country. Therefore, there is no uniform school meal pattern throughout the country. The importance of school meal programme needs to be realised fully in many states. The Schools do not have kitchens, storage facilities, utensils and other facilities. Often there are no cooks and the teacher and the pupils have to spend much time in cooking the meal. Procurement of the financial provision in time, both from the Government and public, is a great problem. The CARE commodities and other food and supplies, are infested with weavils. The collection of these foods from the central godown is yet another problem.

A coordinated national approach can help to solve these problems. The public should be educated on the beneficial outcomes of the school meal and made obliged to provide monetary and physical contribution to the programme. A practical meal plan needs to be drawn out and adapted to the needs of the various regions under the supervision of trained nutrition officers. The school lunch project needs to be integrated with the wider objectives of education with emphasis on better nutrition.

14. PRACTICAL PROBLEMS IN IMPLEMENTATION
OF NUTRITIONAL PROGRAMMES FOR
PRE-SCHOOL CHILDREN

D. P. Dradjat,
*University School of Public Health,
Djakarta, Indonesia.*

15. PROBLEMS IN IMPLEMENTATION OF NUTRITION
PROGRAMMES FOR PRE-SCHOOL CHILDREN
IN THAILAND

Prasert Suvannus,
*Nutrition Division,
Department of Health,
Bangkok, Thailand.*

Nutrition programmes for pre-school children in Thailand had been implemented through the maternal and child health services by the Department of Health. In 1961, the Government of Thailand with the assistance of UNICEF, FAO and WHO launched "An Applied Nutrition Project" to increase food production, to raise the nutritional status of the people especially the vulnerable groups, and to combat malnutrition. In 1967, priority has been given to the improvement of the nutrition of the pre-school child and the day-care centres; "Child Nutrition Centers" have been set up in various provinces. Meanwhile, the Protein Food Development Project has been started and a field trial to combat protein-calorie malnutrition with protein supplements to pre-school children has been in operation, with the co-operation of USAID.

The Nutrition Division faces several problems in expanding the project due to limited money for the construction of the centres, to purchase high protein foods for the pre-school children in the Child Nutrition Centers etc. The lack of water supply for the centres was overcome by the help of the Community Health Development Project. The demand for nutritionists to help Provincial Health Officers in encouraging and supervising the nutrition programme could not be easily tackled. Equipment, materials and supplies for distribution to the centres are very small in number. Self-help is always suggested to those who run the project. It is difficult to reach all pre-school children in the villages, especially during the rice planting and harvesting period, as the parents always take their children with them to the field.

16. CURRENT STATUS OF APPLIED NUTRITION PROGRAMMES IN SOUTH EAST ASIA

M. R. McRoberts,

*Regional Office for Asia and the Far East,
F. A. O., Bangkok, Thailand.*

Applied Nutrition Programmes have been established in many countries of the Asian Region with a varied degree of involvement in co-ordinated activities with co-operating Ministries and Agencies of the Government. The Programmes have varied from (a) comprehensive schemes of inter-related educational activities whose objectives were for the improvement of food production, consumption, and distribution within the local community with special intent to enhance the nutrition of children and mothers, (b) to single measures of practical activity which lacked an integrated effort of two or more Government departments. The degree of success of the National Applied Nutrition Programmes has been variable. The Programmes of each country of the Asia Region will be reviewed in this presentation, especially with reference to their outstanding merits as an emphasis to National Food and Nutrition Policy Planning and to improve nutrition levels of the vulnerable groups of the population.

Applied Nutrition Programmes do not have a standard format of project development. For this reason, comparisons cannot be made of one National Programme with another. The objectives of each Programme have been established to meet priorities of a particular locality, and may or may not be similar to projects in another locality of the same country. However, the more outstanding success stories in Applied Nutrition Programmes have a strong national government leadership within a National Nutrition Co-ordination Committee and with intensive inter-Ministerial co-ordination and co-operation which have provided effective technical and administrative assistance to provincial and local community project efforts.

17. CURRENT STATUS OF APPLIED
NUTRITION PROGRAMMES IN
THAILAND

A. Nondasuta,
*Nutrition Division,
Department of Public Health,
Bangkok, Thailand.*

18. CURRENT STATUS OF APPLIED
NUTRITION PROGRAMMES IN
MALAYSIA

B. Saraswati,
Ministry of Health,
Kuala Lumpur, Malaysia.

19. REVIEW OF FOOD CONSUMPTION SURVEYS IN ASIA

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*Food and Nutrition Center,
Manila, Philippines.*

Published information on nutrition, food consumption, and/or related surveys in Asia are assembled, analyzed, and discussed. The period of coverage and reporting, the number of people involved and their respective areas of location, the Agency(ies) responsible for conducting these, the survey techniques used, and the authors responsible for getting these into print are shown. Significant results are highlighted, and their implications for nutrition policy and programme planning and implementation indicated.

Food consumption patterns and the nutritional contents of existing diets are compared and evaluated in the light of desirable nutritional goals and standards. Emphasis is given to the importance of nationwide food consumption surveys as these have a direct bearing on social and economic development. They are regarded as more sensitive indicators of the quantity and quality of diets as consumed by the population, and are especially important as a complement to national food balance sheets. Available food supplies tend to differ in their regional distribution in the country, and only food consumption surveys will show these discrepancies. Prominent nutritional problems as uncovered by the surveys are cited, and possible action programmes to remedy such problems discussed.

Country reports that are available and have been included in the Review are those of India, Ceylon, Hongkong, Indonesia, Japan, Korea, Laos, Malaysia including Malaya and Singapore, Nepal, Pakistan, Taiwan, Thailand, Vietnam and the Philippines.

20. THE NUTRITIVE QUALITY OF ASIAN DIETARIES

P. R. Payne,

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Keppel Street, London W. C. 1 U. K.*

The history of ideas relating to human needs for protein and energy shows that two separate concepts have evolved. Firstly, that of physiologically defined minimum requirement levels which are of value in assessing the adequacy of diets, and in identifying nutritional problems. Secondly, on a much more questionable basis, of recommendations for 'optimum' or 'safe' diets which are commonly advocated for the planning of national food policies. The scientific basis of such recommendations, and of the concept of optimum diets will be critically discussed.

The use of nitrogen balance as a criterion for evaluating physiological requirements for protein will be reviewed. This approach suggests that adequate intakes of utilizable protein should be about 1.2 g/Kg at the age of 1 year falling to less than 0.4 g/Kg in the adult.

There remain problems however in the evaluation of the limits of error of these values, and also of the extent of individual variation.

Little information is available about the energy needs of different occupation groups especially in rural communities. However, it is possible to make an estimate of the minimum energy needed for maintenance of body weight and of N equilibrium under very sedentary conditions. This figure can be used to assess the degree to which protein deficiency in a community is likely to be the result of an inadequate energy intake rather than of a shortage of protein *per se*.

Protein and energy requirements can be combined together as the ratio of protein to calories that should be provided by adequate diets, and the resulting scale of values are then used to assess the adequacy of the staple foods and food mixtures which form the basis of Asian diets.

21. FOOD CONSUMPTION PATTERNS AMONG PRE-SCHOOL CHILDREN IN INDIA

Ambalini Bailur,

*National Institute of Nutrition,
Jamai Osmania, Hyderabad,
India.*

A dietary survey of pre-school children (age 1 to 5 years) was carried out by 6 research centres in India under the auspices of the Indian Council of Medical Research. Three hundred children were covered by each centre (in the Calcutta, Delhi, Bombay, Poona, Vellore and Hyderabad regions). The method of survey was the oral questionnaire—24 hours recall by the mother of the previous day's food intake of the child. The survey showed that the diets of the children in the different regions were inadequate in calories to an extent of about 30% on the basis of actual body weights but were adequate in protein. The cumulative frequency distribution of the pre-school children surveyed showed that 35% of the children had insufficient intake of protein while 92% had inadequate calorie intake. Thus, protein malnutrition in a majority of cases could be due to a primary insufficiency of calories.

The amino-acid composition of diets of pre-school children from several regions showed that even though the diets were cereal based, lysine was not the first limiting amino acid. In the wheat diet, isoleucine, valine and threonine were equally first limiting. In the rice diet and the mixed cereal diet tryptophan was first limiting. The net protein utilization under operative conditions (NPUop) of these diets ranged from 48 to 54. The protein efficiency ratio (PER) of the rice and wheat diets was 2.18 and 2.16 respectively compared to 3.04 of casein. NPUop studies on the wheat diet supplemented with several amino acids single or in combination showed no benefit of supplementation. The NDP Cals% of the diets of pre-school children was above the recommended value of 4.0 (ICMR 1968 recommendations).

It is concluded that bridging of the calorie gap is the first step needed for improvement of diets of pre-school children.

22. ECONOMICS OF NUTRITION POLICIES

J. L. Joy,

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Andrew Cohen Building,
Falmer, Brighton, U. K.*

Protein-calorie malnutrition can be remedied by a number of alternative patterns of diet supplementation in terms of the amounts and forms in which additional protein and/or calories are provided. It is important to seek least-cost methods of such intake supplementation and known examples of current approaches to this appear to be misguided. These are therefore examined and an alternative approach to the choice of intake supplementation is offered which takes account also of distribution questions. Here the major issue is to determine where effective demand is deficient and how it is to be made good. Policies to stimulate demand cannot generally be considered effectively when divorced from consideration of policies to stimulate supply.

23. POST-WAR CHANGES IN FOOD CONSUMPTION
PATTERNS IN JAPAN

T. Oiso,

*National Institute of Nutrition,
Toyama-cho, Shinjuku-ku, Tokyo,
Japan.*

Food consumption patterns in Japan have changed tremendously since the last war. Cereals, beans, vegetables and fish had been the principal ingredients of Japanese dishes. For about five years over the war, self-supply of food was absolutely insufficient. All agricultural efforts were concentrated to the production increase. Increase in consumption of potatoes and cereals supported the caloric requirement of the population. Vegetables were self-supplied in each house-farm even in the urban area up to 1955. This was the first decade after the war.

Since 1956, the food supply has started to improve and minimum caloric and protein requirements of the people were met. Nutritionists made efforts chiefly to increase the intake of animal protein, fats and minerals. This was the second decade.

The use of bread, instead of rice as a main food, was transitionally recommended in order to save rice-consumption and also to increase the intakes of the above mentioned nutrients. The consumption of eggs and milk increased rapidly and showed signs of plateau in 1968. Consumption of meat, poultry, fats and oils also increased year by year and per capita consumption became two times or more during this decade. On the other hand, the consumption of potatoes and cereals except rice and wheat decreased. Green vegetables also decreased because of the disappearance of house farms. Consumption of soyabean products and fish was constant throughout this decade.

Since 1966, the changes in food consumption patterns were found in the form of food selection within food groups from the standpoint of economics, taste, and Nutrition.

24. IMPACT OF POPULATION GROWTH ON THE FOOD SITUATION IN INDIA

Pitambar Pant,
*Planning Commission,
New Delhi, India.*

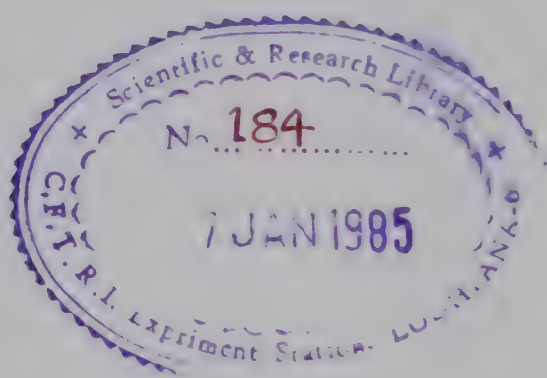
The objective of economic development in India is to provide reasonable standards of living to all sections of the population and its continued improvement over time. A nutritionally satisfactory diet is an essential component of good living. In the context of growing population, the existing high proportion of undernourished population in India, and the limited land available per capita, the problem of providing a nutritionally satisfactory diet assumes vital importance and poses many technical and economic problems.

Significant improvement in per capita incomes is possible only if the rate of increase in production is substantially higher than the rate of growth of population. Problem has to be tackled by reducing the rate of growth of population while at the same time seeking an acceleration in the rate of economic growth. Given the possibility of deliberate control over births and deaths on the one hand and the capacity to bring about, through planning, economic development on the other, it is possible to visualise alternative time-paths to attain the objectives of development. As the pattern of demand and even the pace of development depend not only on the number of people, but also on the structure of population as characterised by age and sex, it is necessary to study the dynamics of population change in some detail.

Scientific knowledge about food composition in terms of nutritional elements combined with physiological needs of people of different sex and age makes it possible to define a nutritionally adequate diet. The prescription of a nutritionally adequate diet should also take into account dietary habits, tastes, and income levels. The problem is to ensure reasonably

adequate and nutritious diet to the population even when the per capita income is very modest.

The supply of food is mainly related to improvement of agricultural methods and the techniques of food manufacture. The possibilities of achieving the level and pattern of food output, consistent with the demand, can be assessed, given the national endowment of the country, the existing state of technology and the prospects of improvements in future. The implications of this, when translated, in terms of the need for expanding irrigation, fertiliser use, plant protection and the continuous efforts at scientific research, bring out the nature of the challenge to be faced.



25. IMPLEMENTATION OF FAMILY PLANNING
PROGRAMMES : LESSONS FROM
THE MAURITIUS EXPERIENCE

C. C. Desilva,
Ambalawatte Estate,
Kotela wala,
Ceylon.

26. DEMOGRAPHIC TRENDS IN ASIA

S. N. Agarwal,
*Demographic Training and
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27. SPECIAL PROBLEMS IN IMPLEMENTATION
OF FAMILY PLANNING PROGRAMMES
AMONG POOR SOCIO-ECONOMIC GROUPS

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28. EXPERIENCE WITH THE USE OF ORAL
CONTRACEPTIVES AND IUCD IN
MALNOURISHED POPULATIONS IN INDIA

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The terms 'Population problem' and 'Population explosion' have developed strong emotional overtones and most countries continue to plan for steady rate of population growth. With rapid development in contraceptive technology, new methods are being made available for use by populations all over the world. Among the newer methods currently in use are the hormonal contraceptives and various forms of intrauterine contraceptive devices.

Fertility inhibiting features of steroids had long been suspected. However, the era of endocrine fertility control commenced with the use of these compounds in human subjects only in 1958. In India, steroids have been used for conception control since 1962. The use of these steroids by malnourished people in India have a greater significance since these steroids are known to produce certain reversible changes in many organs of the body including liver, thyroid, adrenal etc. Reversible changes in the carbohydrate, lipid and protein metabolism etc. are also documented. Experiences of women in India with these contraceptive steroids, keeping in view their metabolic and other side-effects will be discussed.

In India, the intrauterine contraceptive device has been in use since 1962. Discontinuation of the use of the device for menstrual disorders and other side-effects is known to occur in approximately 30 per cent of women. Experience with these devices among populations in India will be discussed in the light of the side-effects reported.

29. FAMILY SIZE AND NUTRITIONAL STATUS

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The widespread prevalence of malnutrition in India could be attributed to growth of population, low purchasing power and inadequate food supplies. During the last twenty years there has been a considerable increase in food production. However, the beneficial effects of such increased food production have been almost completely offset by the concurrent increase in population during the same period. The average annual rate of population growth over the last 20 years has been of the order of 2.5 percent and the total population of the country has risen from 350 million in 1948 to 550 million in 1970. Under these conditions, where there is a limitation of available resources, and particularly among low socio-economic groups it is expected that for any given level of family income, the larger the family size the poorer will be the nutritional status.

In an attempt to check the rapid increase in population and to improve the standards of living an intensive programme of family planning has been launched. Parents are being educated and encouraged to limit the families to three or less children. An assessment of the probable impact of family size on the nutritional situation under the present level of family income and food availability has been attempted.

The data available through diet and nutrition surveys conducted among different population groups and hospital statistics maintained by our Institute have been utilised in the present study.

The results of the analysis reveal that even with the existing standards of living, mere limitation of family size to three or less children can improve the nutritional status of the vulnerable segments by at least 60 per cent.

30. PROTEIN REQUIREMENTS OF PRE-SCHOOL
CHILDREN

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During the last few years efforts have been made by different groups of experts to revise protein requirements of infants. Most of the figures proposed are based on calculations of minimum nitrogen losses during maintenance plus, during childhood, the additional nitrogen needs for the growth of the metabolic mass. Experimental confirmation of these estimates is needed. In our laboratories we have been conducting controlled studies to determine the minimum intake of "ideal" protein (egg) for children 2-3 years of age. Biochemical and nitrogen balance data indicate that an intake around 1.00-1.25 g/kg/day-is adequate. This agrees well with previously estimated figures. Observations on infections and immuno-globulin levels of the study-children suggest that the more frequently infected children have a higher protein requirement. This may account for a large part of the variability observed even under the well controlled conditions of a metabolic ward.

31. PROTEIN REQUIREMENTS OF ADULTS

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32. HUMAN AMINOACID REQUIREMENTS AND
PROTEIN QUALITY

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33. REGULATION MECHANISMS IN PROTEIN METABOLISM AND THEIR BEARING ON HUMAN NUTRITION

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Recent studies on regulatory mechanisms in protein metabolism are relevant to the utilization of dietary protein by man. First, there have been extensive investigations of the response of the liver to amino acids absorbed after each meal. Transient increases in protein synthesis and a reduction in rates of protein and RNA breakdown during the absorptive period result in meal-related changes in liver composition. In the rat, this accounts for diurnal rhythms in liver protein synthesis and in the levels of some liver enzymes. Second, the significance of these liver changes in determining utilization of dietary protein is beginning to be explored, using animals fed on diets containing different amounts of one essential amino acid. These studies suggest that, for a given essential amino acid, the liver enzyme system degrading that amino acid does not increase in activity until the diet provides an excess of the amino acid above requirements. Under the same experimental conditions, there is also a sharp increase in the systemic blood levels of an essential amino acid when intake is raised above the point of meeting requirements. While not yet extended to many essential amino acids, these studies nevertheless suggest that abrupt changes in liver enzyme activity and blood amino acid level may prove to be useful indices of the point at which requirements have been met. Third, amino acid metabolism is under hormonal control, and the secretion of some hormones is sensitive to the levels of free amino acids in the plasma. Thus feedback control loops involving free amino acid levels may integrate hormonal secretion with amino acid intake. Finally, there are now many studies showing differences in the intensity of protein metabolism in different species of mammal. These observations demonstrate that it should not be assumed that findings obtained with small mammals can be quantitatively transferred to man.

34. EVALUATION OF PROTEIN QUALITY

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The primary function of dietary proteins is to provide amino acids in appropriate patterns for the synthesis of tissue proteins during growth and for the maintenance of established cellular nitrogenous constituents and for other metabolic needs. The nutritive value of a dietary protein is an expression of its ability to meet the protein needs of the body. In evaluating the quality of proteins, we have to take into consideration the following: (1) factors which affect the quality of proteins and (2) methods for evaluating protein quality. The important factors which affect protein quality are (i) essential amino acid composition (ii) amino acid imbalance (iii) biological availability of essential amino acids (iv) interference of non-available carbohydrates in protein utilization (v) interference in protein utilization by trypsin and growth inhibitors and (vi) influence of heat processing on protein utilization. Further the quality of dietary proteins will have to be assessed by animal experiments and experiments on children. Among the several biological methods available for the evaluation of protein quality, the Protein Advisory Group of the FAO/WHO/UNICEF recommended two methods for general use. The two methods are (i) determination of protein efficiency ratio by rat growth method and (ii) determination of net protein utilisation (NPU) of the protein. The committee on protein Malnutrition of the Food and Nutrition Board, National Academy of Sciences, U. S. A. have stressed on the need for conducting growth studies and nitrogen metabolism studies in children to assess the quality of dietary proteins. In addition it will be desirable to assess the value of the protein in the treatment of protein deficiency states in children as compared with a standard protein such as milk proteins.

35. PROBLEMS IN THE AUGMENTATION OF PROTEIN-RICH FOODS FROM PLANT SOURCES

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The importance of developing new sources of good quality protein to bridge the ever-widening 'protein gap,' especially in the densely populated countries, cannot be overstressed. Efforts are being made in several directions, with varying degrees of success, with the common objective of a quantitative as well as qualitative improvement of protein resources.

The developing nations, because of a host of climatic, cultural, religious and other factors, will have to rely largely on their agricultural potential for the production of the needed protein from vegetable sources. Animals are notoriously inefficient at converting feed to meat and it would be both uneconomical and impractical to divert large quantities of calories for the production of animal protein. Opinions on the nutritional irreplacability of animal proteins by plant proteins are outdated and misconceived in the light of our recent knowledge of protein and amino acid nutrition. A shortening of the food chain, by placing greater reliance on plant proteins, suitably supplemented to correct for deficiencies, will thus offer the brightest prospect for increasing protein availability.

Various sources of plant proteins, some of them new or hitherto unutilised, are available to meet man's requirement for the future; their potentials and limitations will be critically examined. Nutritional improvement of plant proteins through agronomic practices, genetic means, fortification and the application of technology, are all practicable.

Much attention has also been paid in recent years to improving the acceptability of plant protein foods through incorporation of desirable attributes. A promising beginning has been made in creating products with qualities that one looks for in any item of food. Of particular note are the development from plant proteins of acceptable high-protein soft drinks and textured foods that simulate a variety of natural foods. Clearly, technology will have to play an increasingly important role in the promotion of protein foods from vegetable sources.

36. APPROACHES TO AMINO ACID AND VITAMIN
ENRICHMENT PROGRAMMES IN JAPAN

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Various programmes have been put into operation in Japan to improve the nutritional quality of rice, the staple food since 1885 when the first experimental evidence that beriberi, a serious condition of athiaminosis, is a food-originated malnutrition was provided. During the period of these operations, under-polished or germ-retaining rice, parboiled rice, and the "enriched rice" of premix formula were recognized to be effective and practical for the improvement of national nutrition. The former two rice products have now been completely abandoned due to their poor palatability and the limited availability of the vitamin from the grains. Vitamin B₁ "enriched rice" produced by the "acid-soaking method" has been on the Japanese market since the beginning of 1951 and its annual output now exceeds ten thousand metric tons. Statistics revealed that the "enriched rice" confers benefits on about one-third of the Japanese population. Fortification with lysine, another nutrient often found deficient in Japanese diets, became feasible as the price of the amino acid of food additive grade declined and the nutritional significance of the fortification was well recognized. Lysine "enriched rice" prepared by the "acid-soaking method" is available in the market.

Details of the "acid-soaking method" which has proved to be one of the most effective methods for the fortification of intact cereal grains, and the nutritional impacts brought about by the "enriched rices" will be presented.

37. NEW DEVELOPMENTS IN INFANT AND WEANING FOODS

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The urgent need for infant and weaning foods in technologically less advanced countries of the world is well recognised. There is acute shortage of milk and the resources for increasing animal proteins in most of these countries are very limited. The problem of protein-calorie malnutrition can be solved to a substantial extent by developing nutritionally balanced weaning foods to meet the requirements of vulnerable groups of population particularly weaned infants. The production of vegetable protein requires about a fifth of the land and less than a tenth of water for its production as compared to animal proteins. Efforts have, therefore, been made to develop supplementary and substitute protein foods which offer good market potential. In manufacturing these products, precautions have to be taken to ensure use of good quality raw material free from toxins and deleterious substances. Processing conditions have to be standardized to prevent deterioration of the quality during manufacture. With judicious blending of carefully selected raw materials, the amino acid content of the finished product has been balanced to ensure sufficiently high nutritive value. The product can be fortified with vitamins, minerals and aminoacids where necessary.

38. PRESERVATION AND PROCESSING IN
AUGMENTING THE SUPPLY OF
PROTEIN FOODS

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39. PROBLEMS OF FOOD ADDITIVES AND
CONTAMINANTS

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Direct additives to food such as antioxidants, emulsifiers, colours, flavouring agents, etc., are generally controlled by Government and are accepted or rejected for use on the basis of 'need'. Contaminants on the other hand occur in foods often adventitiously due to 'environmental pollution' and sometimes due to careless handling or faulty processing. The consumer is entitled to Government protection on the safety, quality and nutritive value of food, and in these days of mass production, urbanised living and advertisement-induced buying habits, it is the prime responsibility of the Government to ensure that the nutritive benefits of food are conveyed from the field to the table with minimal impairment of values.

Our present interest in food additives stems from our national commitment to provide not only more food but better nutrition. In this regard increasingly onerous and time-consuming testing requirements for clearance of food additives by regulatory authorities make high demands on financial and scientific resources of the industry. However, there is no basis for assumptions that chemicals occurring in nature and eaten by man are necessarily better than others identified solely from a technological background—in fact from many points of view a closer look at many of commonly used items of diet seems warranted. Some of these problems will be examined in relation to the concept of tolerances, the 'poison per se' doctrine and the lack of pace between legislative 'regulation' and technological 'flexibility' in product development.

40. MECHANISMS OF ADAPTATION TO LOW PROTEIN INTAKES

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The first effect of a low protein intake is a reduction in urinary nitrogen output. We have been concerned to try to find out how this is produced. Measurements in both children and experimental animals suggest that a low protein intake does not cause any significant reduction in the amino acid flux, or total amount of amino-N entering the body pool in unit time. Instead, there is an alteration in metabolic pathways, such that a smaller proportion of the N entering the pool is catabolized to urea. This is produced by adaptive enzyme changes in the liver.

Although total turnover may be unchanged, the pattern of protein synthesis is changed; in protein deficiency synthesis is well maintained in liver, reduced in muscle. Much recent work emphasizes the important role of muscle metabolism in protein homeostasis. Another possibility which must be considered is that the limiting factor in adaptation may not be the ability to economise N, but rather the ability to conserve the carbon skeletons of the essential amino acids.

41. PHAGOCYtic RESPONSE OF LEUCOCYTES IN PROTEIN-CALORIE MALNUTRITION

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The increased susceptibility to infection observed in protein-calorie malnutrition can be due to a poor response of either the immunological system or the phagocytic system. Phagocytic response to malnutrition was studied in kwashiorkor patients using the metabolic-bactericidal activities of peripheral blood leucocytes as parameters. Leucocyte glycolytic activity, which provides the necessary energy for particle uptake, failed to increase during phagocytosis in the patients, in contrast to the stimulation observed in normal subjects. The direct oxidation of glucose through the hexose monophosphate shunt was also stimulated to a markedly lower extent during phagocytosis in leucocytes isolated from children suffering from protein-calorie malnutrition. Evidence was obtained to show that these metabolic defects occur due to changes in the leucocyte and not due to altered serum factors. The leucocytes also exhibited a significantly reduced bactericidal activity indicating the involvement of the phagocytic system in the decreased resistance to infection found in these patients. The metabolic activities and bactericidal activities returned towards normal following treatment. The relationship between the altered leucocyte metabolic activities during phagocytosis and their physiological functions in malnutrition will be discussed.

42. PATHOLOGY OF EXPERIMENTAL PRIMATE KWASHIORKOR

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Pathophysiology of the lesions induced by protein deficiency in different organs was investigated in a group of young growing rhesus monkeys. Within a few weeks of protein deprivation the animals developed lesions characteristically observed in kwashiorkor. Thus they showed failure of growth, fall in total proteins and serum albumin, moderate anaemia, a fatty liver, atrophy of the pancreas and salivary gland, muscle and small bowel and reduction both in the endochondral and appositional bone growth. The phagocytic function of the R. E. cells and both the primary and secondary immune responses were significantly depressed. These lesions and their pathogenesis will be described in detail. Based on the sequence of appearance of lesions as well as a study of cell proliferation kinetics an hypothesis has been developed that involvement of the organs of high protein and high cell turnover is the basic lesion of protein deficiency. Inter-relationship of malnutrition and some clinical disorders such as tropical sprue and osteoporosis will also be discussed.

43. HORMONAL RESPONSE TO PROTEIN-CALORIE
MALNUTRITION

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The concept that in endocrinological terms, chronic malnutrition reminds the experimental condition known as "pseudohypophysectomy", was already challenged seventeen years ago, on grounds of clinical observations made on a series of adult females with secondary malnutrition. Instead, a state of peripheral resistance to hormone action was hypothesized. Approached with more modern resources, endocrine secretory capacity has in fact been shown to be adequate in most cases of protein-calorie malnutrition, at least for thyroid, adrenal and growth hormone, and for insulin. Studies on regulatory capacities have shown discrepant results between "kwashiorkor" in pre-school children and "marasmus" in small infants, while there is suggestive evidence for significant errors in the metabolic sequences leading to the biosynthesis of several hormones. The real significance of these characteristics for regulation of body composition and physiology, is still a matter of speculation.

44. NEUROCHEMICAL RESPONSE TO PROTEIN-
CALORIE MALNUTRITION

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45. SOCIAL AND CULTURAL FACTORS IN MALNUTRITION

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The prevailing food habits, traditions, customs, and beliefs are some of the most important socio-cultural factors affecting nutritional state. Curiously enough, traditional dietary restrictions have been found to apply most often to the nutritionally vulnerable groups: infants, toddlers, and pregnant and lactating women. Some highly nutritious foods are among those which are restricted particularly animal protein sources and others classified under protective foods. Other non-dietary factors such as social organization and community structure are just as relevant in understanding local food habits.

Because each culture differs from others, people see and understand things in different ways. Culture is like a screen through which an individual views the world, and the values which a society gives to foods are always part of the total design and have to be understood as a whole.

Knowledge of the socio-cultural factors underlying existing food habits while important, however, cannot be used where it is needed unless the people themselves want to use it, know how to do so, and are prepared to accept the changes necessary for its effective use. It is unfortunate that the psychological, social, and cultural factors, which create barriers against rapid changes in food habits are less well understood than the impersonal aspects of nutrition and malnutrition.

The behavioral sciences can help us understand food habits as an inseparable part of the total pattern of human behavior. Food habits are woven into the entire way of life of a people, whose culture must be understood to effect changes in food habits with a minimum of disruption. Nutritionists can draw upon the expertise of social scientists in elucidating the human factors involved in changing food habits, to ensure their greater acceptance. Recommendations aimed at changing dietary patterns must have solid scientific backing and should at the same time enable the individual to choose the desired alternative. The skills and techniques of the educator are of paramount importance in effecting a programme that will be acceptable to the great majority.

46. ENVIRONMENTAL FACTORS IN INTERRELATIONSHIP OF NUTRITION AND INFECTION

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Environmental factors involved in the multiple causation of both nutritional and infectious diseases are not only physical and biological, but also social.

All three kinds of environmental factors influence the *availability of nutrients* by affecting the kinds and productivity of the plants and animals which can be raised and the efficiency of techniques for food production. They also determine the amount of crop wastage due to insects, rodents, mold, and simple spoilage.

Environmental factors influence human *requirements for nutrients* in many ways. Temperature, clothing and level of activity are physical and social factors which affect the need for calories as well as the losses of nutrients through sweat. Infectious diseases coming from the biological environment increase body losses of some essential nutrients and simultaneously result in reduced food intakes. Social factors in the environment are the major determinants of the actual *intake of nutrients* by the host. In this category are dietary practices and economic considerations.

The high frequency of malnutrition among vulnerable groups such as pre-school children, pregnant women, and nursing mothers in developing countries is due to the combination of adverse environmental circumstances, mainly biological and social, interacting with the host factors responsible for increased nutrient requirements. To the extent that host factors such as increased nutrient needs during growth, pregnancy, and lactation cannot be altered, the only effective approach to the prevention of malnutrition lies in modification of environmental influences. Careful analysis of the complex of multiple causation is required to determine those factors that can be altered most easily and inexpensively.

47. EFFECT OF MATERNAL ATTRIBUTES ON MALNUTRITION IN CHILDHOOD

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Childhood malnutrition is one of the major public health problems in many developing countries. Among important contributory factors are low purchasing power, limited availability of food and faulty feeding habits. The growth performance of most children belonging to the poor income groups in India is sub-optimal. Among children apparently exposed to the same unfavourable environment, only a small proportion develop signs of advanced protein calorie malnutrition, while the rest show only signs of mild and moderate growth retardation.

One of the factors that may influence the incidence of frank kwashiorkor in a poor community may be related to maternal-child relationship. The level of intelligence, motivation and resourcefulness of the parents, particularly of the mother may be important. Studies were, therefore, designed to find whether such maternal attributes played a key role. Evaluation of the mother's knowledge regarding her concepts of food values, weaning practices, her concern for the child's health, her attitudes towards general health care as well as her performance in intelligence tests showed marked differences between mothers whose children had suffered from kwashiorkor and mothers whose children did not have nutritional diseases, though both groups of mothers were drawn from the same community.

These observations acquire significance in the context of the suggestions now being made (a) that the active participation in educational programmes of mothers of children with kwashiorkor may be a method of controlling protein-calorie malnutrition in a community; (b) and that poor mental performance of undernourished children may be due to malnutrition in early childhood.

48. HUMAN MILK AS AN ECOLOGICAL FORCE
A REVIEW OF SCIENTIFIC KNOWLEDGE

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In westernized urbanized communities, to advocate breast-feeding is regarded as unreal, unnecessary and faddist-out-of-touch with scientific trends and technical developments. The contrary is the case, and this presentation outlines recent scientific research into newly identified, biochemical and anti-infective properties of human milk.

Additionally, recent evidence concerning the advantages of breast-feeding is presented, as regards emotional development, economics and convenience.

These advantages are universal, but of vital significance in communities with low purchasing power and limited environmental sanitation.

49. THE ECONOMICS OF MALNUTRITION

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Compared with other claimants for scarce resources, nutrition has been at a disadvantage because we have often been unable to specify the impact of malnutrition on the economic development of a country. We have lacked a systematic description that relates malnutrition to development, via impact on individual and national productivity and the quality of the labour force, curative medical costs, mortality and morbidity that cause losses in past investments in human capital, child growth and effects on educability and mental potential, and population growth. Thus, we lack systematic and tangible arguments for presenting a case to the policy maker. One purpose of this paper is to lay out these relationships, to suggest strategies for developing a better understanding of malnutrition's relation to economic growth. The translation of poor health impact on individual productivity, which has been studied under laboratory conditions and in a few field situations, into impact on the general economy, has been done largely for developed economics where malnutrition is a minor problem and where the labour force is generally nearly fully employed. The malnutrition problem of the developing countries differs from the illness problems of the developed countries in significant ways, requiring a fresh approach.

The paper also looks at nutrition as consumption. Food claims a large share of developing country resources. The

answer to Why Development? for most people at subsistence income levels is food and physical well-being. Demand for nutrition is not separated by most consumers from demand for food to satisfy hunger, nor is nutrition well understood. New technologies in nutrition offer possibilities for previously unavailable low-cost means of meeting the demand for the nutrition component of well-being, at levels of income much lower than the levels at which diet becomes satisfactory under conditions of more advanced economic development.

We have also lacked programme strategies that appeared feasible as means of reaching large numbers of the undernourished within developing country resource constraints. Partly based on the new technologies, but also exploring policy tools suggested by a systematic analysis of the socio-economic context surrounding malnutrition, the paper will sketch an outline of the steps for developing a comprehensive approach: analysis of the problem, definition of targets, description of alternative solutions, delivery systems and policies, design and implementation of programmes.

50. ENDEMIC GOITRE IN SOUTH-EAST ASIA

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Goitre has been known to be endemic all along the Himalayas involving India, Pakistan, Nepal and Afghanistan. It extends into Burma and Thailand and is known to occur in Ceylon and Indonesia. Recent studies of Himalayan Endemic Goitre indicated that the endemic is attributable to environmental iodine deficiency. Iodine deficiency in the Himalayas is severe and is frequently accompanied by manifestations of developmental disturbance in the form of deaf-mutism and cretinism. The thyroid is enlarged and hyperplastic even at birth in this area and nodular transformation occurs at a relatively young age. There is no evidence to suggest that inherited abnormalities in the handling of iodine and synthesis of thyroid hormones play any part in the genesis of endemic goitre in this region.

The thyroid makes a series of exquisite adjustments to iodine lack. Thyroid glands of the goats living in the endemic area show higher Monoiodotyrosine/Di-iodotyrosine and Tri-iodothyronine/Thyroxine ratios than the thyroids of goats living in an area of iodine abundance. There is also a higher incorporation of ^{131}I in 27s iodoproteins in the thyroids of iodine deficient goats.

Introduction of iodised salt into an experimental area in the Himalayan goiter belt was followed by a dramatic reduction in goitre incidence. The story of endemic goitre in South-East Asia provides an insight into the problems involved in the diffusion and transfer of scientific knowledge towards the solution of health problems in developing societies.

51. THE PROBLEM OF ZINC DEFICIENCY IN
THE MIDDLE EAST

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In Iran and other countries of the Middle East, notably Egypt, failure of boys to undergo sexual development and growth at the age of puberty is not uncommon. The resulting syndrome of dwarfism and hypogonadism has been known for 50 years, but it was Prasad *et al.* (Am. J. Med. 31, 531 (1961)) who drew attention to deficiency of zinc as a possible cause. Evidence that zinc has indeed a causal role has been obtained by feeding 120 mg. of zinc sulphate per day together with a well-balanced diet to nine randomly selected dwarfs. They grew at an average rate of 10.2 ± 3.7 cm. (S. D.) in a 6 month period, while 7 control dwarfs grew only 4.2 ± 1.9 cm. on the same diet and a placebo. Maturation of genitalia and development of sexual function occurred in both groups but proceeded more rapidly and made more progress in those receiving zinc. These findings confirm those of Sandstead *et al.* (Am. J. Clin. Nutr. 20, 422 (1967)) in Egypt. The resumption of growth and maturation of genitalia is the more remarkable because ages of the dwarfs ranged from 19 to 23.

The syndrome has been described for the first time in two dwarfed hypogonadal females aged 18 and 19. Their response to zinc and good diet was like that of the males.

The medical records of the Iranian army showed that 3 per cent of 19 year-olds eligible for conscription were rejected because of growth retardation attributed to malnutrition. However, treatment of preadolescent children with zinc and a supplement of high quality protein and fat failed to stimulate growth. These findings suggest that zinc does not become limiting until the age of puberty.

All of the syndromic youths lived in villages, both in Iran and Egypt. It is believed that the detrimental factor in the village environment is a high intake of phytate.

52. ENDEMIC FLUOROSIS

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Endemic fluorosis is a form of chronic fluoride intoxication due to ingestion of excessive quantities of fluoride through drinking water. This disease produces characteristic dental and skeletal changes, and in advanced cases neurological changes of radiculomyelopathy.

Southwestern region of Punjab (India) is one of the most hyperendemic areas of the world. Extensive work on epidemiological, clinical and biochemical aspects has been done in Patiala in the last 12 years and it shall be presented in this paper. Over 1300 cases of skeletal fluorosis have been studied. The details of clinical, radiological and histopathological aspects of this disease will be presented. Neurological complications in 80 cases will be described in detail.

There are many factors which influence the development of this disease and these, as studied through intensive village surveys, will be described. Data regarding fluoride estimations in water, blood, urine, bones and soil and the results of calcium balance studies will be presented.

53. URINARY LITHIASIS IN THAILAND

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Lithiasis of the lower urinary tract is still a major health problem in many developing countries of the Middle East, Near East and Far East. In Thailand, this disease is still endemic in rural areas of the North and Northeast.

Urolithiasis or Bladder Stone Disease occurs predominantly in children; about 50 per cent of patients are under 5 years of age and the rate of recurrence following surgical removal is very low. The disease generally occurs in children of low economic class, mostly in the farming community. The stones are usually composed of ammonium acid urate and calcium oxalate.

Some pertinent findings of the investigations in Thailand, including epidemiological, nutritional and biochemical, are as follows :

- a) the rates of positive stone episodes per 1000 population were 14.2 in villages and 2.1 in city and the highest age incidence is between 2 to 4 years;
- b) Urinary phosphate and sulphate excretions were lower in village than the city infants. It is postulated that low excretion of these two compounds reflects the low intakes; and
- c) oxalate crystal was commonly found in urine obtained from village infants. On the contrary, none of the city infants of the same age group had oxalate crystalluria.

As has been reported previously, experimental animals form uroliths when fed a diet deficient in inorganic phosphate or when their diets contain marginal level of protein. Possible role of these two nutrients in the etiology of bladder stone disease in Thailand will be discussed.

54. PELLAGRA IN SORGHUM EATERS

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Pellagra ranks as one of the major nutritional deficiency diseases in and around Hyderabad. The staple of the poor segments of the population here is the millet, sorghum vulgare and not maize. Contrary to the traditional view of the pathogenesis of pellagra in maize-eaters, the tryptophan content of sorghum is not low and nicotinic acid in this millet is not in a bound form.

A feature that is common to both maize and sorghum is the high content of leucine. The possible role of excess leucine in the pathogenesis of pellagra was therefore investigated.

Oral administration of leucine to pellagrins and normal subjects caused disturbances in tryptophan metabolism in the form of increased quinolinic acid excretion and a decrease in excretion of the 6-pyridone of N-methyl nicotinamide.

Direct evidence for the role of leucine was obtained by production of black-tongue and pellagra in dogs and monkeys, respectively after feeding sorghum diets.

Oral administration of leucine depressed nicotinamide mononucleotide synthesis in erythrocytes of pellagrins and normal subjects. 20-30 g. leucine daily for 7 days produced marked deterioration of the mental condition of pellagrins. This was accompanied by significant alterations in the EEG pattern. Studies also indicated adverse effect of leucine on serotonin metabolism, which may possibly explain mental changes in pellagra.

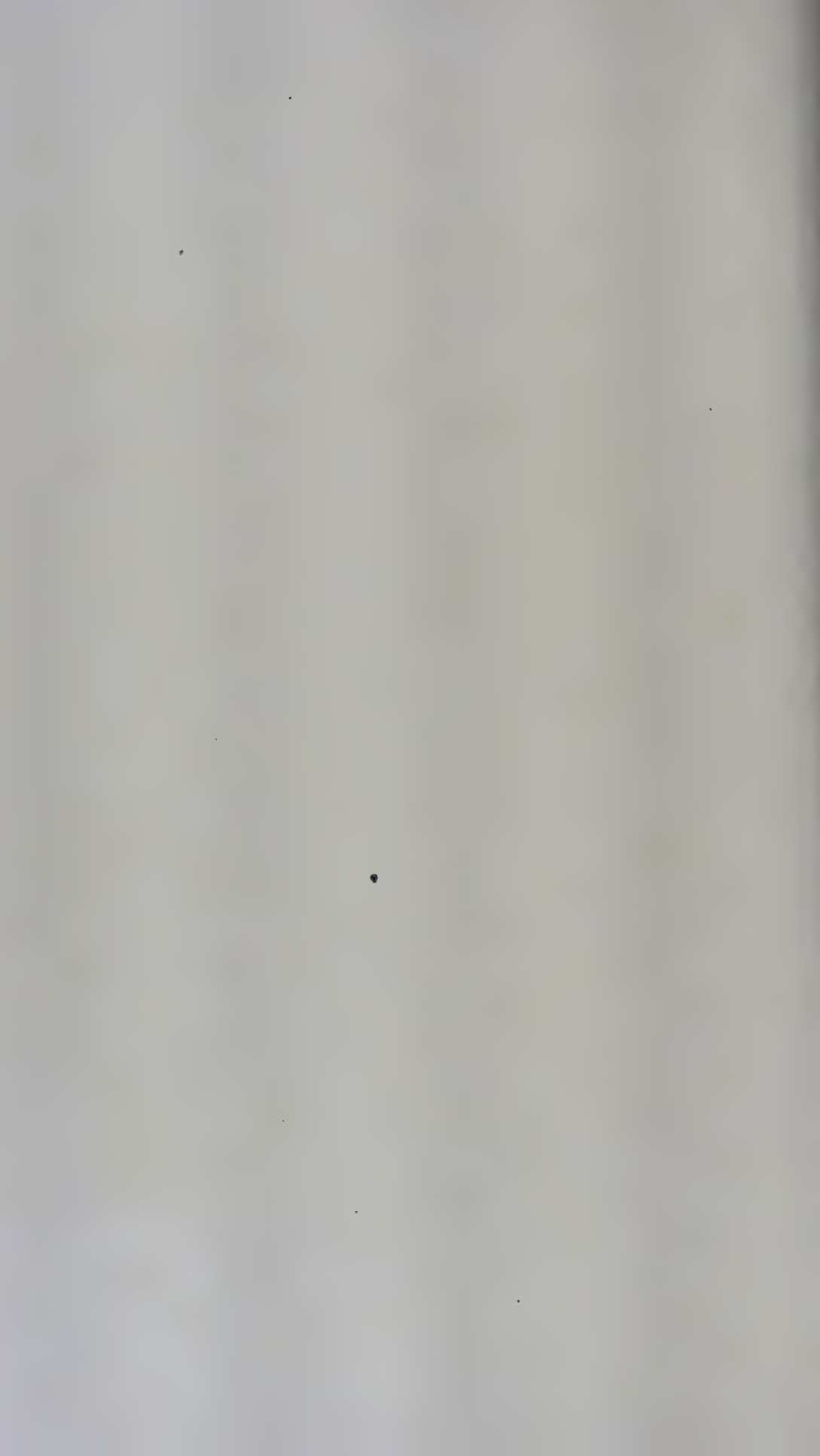
Clinching evidence for role of leucine in pellagra was recently provided when pups fed opaque-2 maize, which has a low leucine content, failed to develop black-tongue.

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SPECIAL REPORTS



1. PLANNING FOR AGRICULTURAL DEVELOPMENT IN INDIA

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New Delhi 12, India.

The first part of the paper is an analytical review of the evolution of agricultural planning to-date. This is followed by a critical appreciation of the specific experiences of the previous plans leading to the approach, strategy, technique and programme content of planning for agriculture in the Fourth Plan. The two major foci of the current plan are quantitative increase of agriculture production through research-based and input-oriented programmes and the accomplishment of agricultural growth with social justice as between classes and areas through a series of special programmes. These objectives are illustrated. This is followed by an analysis and presentation of programmes of development covering quantitative and qualitative improvement of food supply and product diversification including the fields of animal husbandry, dairy, fisheries, horticulture, food processing, supply and distribution. The matching arrangements for development of necessary infra-structure, institutions and institutional reforms are dealt with in some detail. Special attention is given to minor irrigation, financial institutions, land reforms, storage, marketing and communications. The arrangements for timely and adequate supply and distribution of inputs are treated separately. The specific problem of employment as it relates to agricultural programmes is brought out. A separate section deals with the emerging problems and tasks relating to the managerial aspects of development including the coordination of institutional arrangements. This is illustrated by case studies of the co-ordination machinery and rural development and nutrition programmes. Finally the paper sets out in brief the various issues relating to the strengthening of machinery for planning, implementation, review and evaluation of agriculture and allied programmes including agriculture administration. The dominant role of State Governments in agricultural development is also explained.

2. CURRENT PROGRAMMES FOR IMPROVEMENT OF GRAIN STORAGE IN INDIA

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New Delhi, India.*

Loss of foodgrains in the post-harvest period in India is estimated at 9.3% by an expert committee. Significance of the loss from the point of view of availability of food and national resources is fully appreciated. Programme undertaken to minimise loss covers six different sectors, namely (1) Storage facility, (2) Quality standards, (3) Pesticidal measures, (4) Research and training, (5) Promotional activity and (6) Legal steps. In regard to storage facility eleven different designs for commercial warehouses have been tested and a standard evolved for a rodent-damp and termite proof masonry structure. Surveys to decide requirements and locations have been undertaken and a capacity of 4 million tons for the storage of foodgrains put up during last 10 years. Further addition of another 2 million tons is likely in the course of next few years.

As a country growing hundreds of varieties of cereal grains, India had traditional methods of quality assessment which were mostly person-oriented. Work leading to development of a uniform technique and basis for assessment of quality during last few years has borne fruit and there are now over 70 grain analysis laboratories and over 1000 technicians engaged in quality assessment on scientific lines.

Damage due to pests is heavy under Indian climatic conditions. Mixing of pesticides with food grains is not, however, encouraged. Emphasis is more on non-residual fumigation and annually, around 10 million tons of foodgrains are now fumigated in the country. Resources developed at the Centre are being popularised in five different States of the country on a large way through the agricultural extension programmes. In the last 10 years over 3000 workers have been trained for carrying out the storage modernization programmes.

Details of these programmes are mentioned in the paper and factual data on how losses have been reduced through these programmes have been discussed. Hazards associated with the use of pesticides on a large scale have been brought out and how these have been successfully avoided in India, described.

3. REPORT OF THE INTERNATIONAL SYMPOSIUM
ON METHODOLOGY FOR ASSESSMENT OF
NUTRITIONAL STATUS, TOKYO, 1970.

N. Shimazono,
*Department of Biochemistry,
Tokyo Medical College,
Tokyo, Japan.*

The International Symposium on Criteria and Methodology for Assessment of Nutritional Status (Interpretation of Nutrition Survey Data) was held at the Nippon City Center Building in Tokyo on the 6th and 7th November under the auspices of the Malnutrition Panels of the U.S.-Japan Co-operative Medical Science Programme. Sixteen nutritionists were invited to participate in this Symposium from Asian countries (Republic of China, Indonesia, Korea, Malaysia, Philippines and Thailand), besides twelve American and seventy Japanese nutritionists. The symposium consisted of the following four sessions, and 41 papers were presented with very interesting and fruitful discussion.—Session I. Clinical, anthropometric and dietary data; Session II. Biochemical, hematological and endocrinological data; Session III. Psychomotor cognitive, behavioral and electroneurological data; Session IV. Data on physical performance, vital statistics and response to infection.

4. REPORT OF THE TECHNICAL GROUP
MEETING (I. B. P.) ON LEAF PROTEIN
(COIMBATORE, 1970)

Rajammal P. Devadas,
Sri Avinashilingam Home Science College
Coimbatore, India.

Forty people, with experience in agronomy, biochemistry, food technology, animal nutrition, home science and large scale production attended a three day "Technical Group" meeting on leaf protein organised by the International Biological Programme at Coimbatore from November 25-27, 1970.

So far, the protein that has been made in quantities adequate for feeding trials has come from conventional crop plants. A very large group of fast growing plants of species that are not now used in agriculture should also be examined. Plants, that can be grown and harvested on a field scale are obviously the main potential source of protein. Water weeds are also a possibility. Many crops yield 3 or 4 times as much extractable leaf protein, per hectare and year, as can be produced by any other system of agriculture.

Proteins from different species or harvested at different stages of growth have a uniform amino acid composition and the distribution of amino acids is similar to that in FAO "reference protein".

Feeding experiments on various animal species were discussed. The possible explanations for some disagreement between amino acid analyses and the results of animal feeding were considered. These will be the subject of further research.

Leaf protein improves nitrogen retention in infants and growth in children. It is more difficult to reach firm conclusions about acceptance by adults with established food habits. The importance of example and of choosing the best conventional food as a vehicle for leaf protein was stressed.

The leaf protein used in these acceptance trials contains lipid and chlorophyll. Some participants felt that acceptance would be easier if solvent—extracted material, which is pale brown rather than green is used. The experience of others shows that dislike for the green colour is soon overcome. Furthermore, solvent extraction would greatly increase the cost of the product. Much of the carotene of the leaf accompanies the protein and it would be removed by solvent extraction. Because of the importance of leaf protein as a carotene source, it was agreed that the lipid should be retained.

The basic argument for leaf protein production is that by using crops while still in the vegetative stage of growth the yield is enhanced. The fibrous residue after leaf protein extraction contains 30 to 35% of dry matter compared to 8 to 12% in the raw crop. This factor alone makes leaf protein production an attractive proposition in U. S. A.

Those who have advocated leaf protein production have, from the very beginning, conceived it as an integrated process of fractionation in which raw material is suited to a different use. The technical Group fully endorsed this approach. Between 10 and 30% of the dry matter of the leaf is soluble in water and appears in the whey that separates when protein is coagulated. The merits of the different approaches to utilise whey will be examined more fully in future.

Bearing all these factors in mind, the participants agreed that research on leaf protein and the general problem of leaf fractionation should be encouraged. They agreed on a set of recommendations.

5. REPORT ON THE FIRST SOUTH EAST ASIAN
REGIONAL SEMINAR ON NUTRITION - SEAMEC,
DJAKARTA. OCTOBER 27 - 31, 1968

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There is a great similarity in the kind and frequency of malnutrition as well as in the factors leading to these deficiencies in the South East Asian countries.

For this reason it was considered useful by the Central Coordinating Board on Tropical Medicine and Public Health of the SEAMEC, (South East Asian Ministers of Education Council) to organize the First South East Asian Regional Seminar on Nutrition.

A National Food Policy is one of the measures to combat malnutrition.

To prepare the medical profession for its duties in a National Food Policy, the topics chosen in the Seminar were:

- I. Population Problem and Family Planning in relation to Food Supply and Consumption.
- II. Public Health and Clinical Nutrition Problem in South East Asia.
Dietetics in the SEAMEC Countries. Parameters of Health and Nutrition.
- III. Menu patterns in the SEAMEC Countries and its relation to the existing Deficiency Diseases. Food Composition Tables. Nutrition and Food Allowances.
- IV. Evaluation of Food Supply and Consumption. Protein and Carbohydrate Sources. Processing and Marketing of Food.
- V. Institutional Development in Nutrition. Teaching of Nutrition in Medical Schools.

A programme for a Post Graduate Course in Nutrition was also discussed.

The total number of participants was 119, representing 10 countries and 13 agencies.

6. REPORT ON THE SECOND WORLD FOOD
CONGRESS, THE HAGUE, 1970.

Dorothy Hollingsworth,
British Nutrition Foundation Ltd.
93, Albert Embankment,
London, S. E. 1.
U. K.

7. CURRENT FOOD FORTIFICATION
PROGRAMMES IN INDIA

P. K. Kymal,
*Food and Nutrition Board,
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New Delhi, India.*

8. THE IMPACT OF INDUSTRIALISATION ON FOOD CONSUMPTION PATTERNS

M. Mathias,
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Backbay Reclamation,
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The urban environment has an all-pervasive and at times traumatic impact on the recent rural migrant. It conditions his daily routine, determines his friends and neighbours, introduces him to new products, ideas, ways of life and leaves him exposed to the multi-media of press, cinema, radio, hoardings and the rest. Little wonder that he gradually changes in his attitudes, his clothes and perforce he learns a new language, but his food habits die hardest. He hangs on tenaciously not only to the dishes his mother made, but also her ideas on nutrition.

The steady exodus from the farm to the factory and the town brings in its wake major problems for the logistics of food supply, which can only be met by food processing which will preserve food, possibly reduce its bulk, render it more susceptible to transport and storage, distribution and delivery. On the face of it this would appear to be a challenge only to the food scientist and technologist, but in fact if it is to be successfully tackled, it must involve the plant scientist, the agronomist, the commercial man and all the skills and techniques of the marketing men.

In brief, the task is to achieve the economies of scale both in agriculture and in processing, and to make available to the urban population processed food in the form they find acceptable, at a price they will pay and of a high nutritional quality. This problem is rendered particularly difficult in Eastern and developing countries, where tastes in food vary widely, where the factor of convenience is not adduced much value, where there is a natural prejudice against processed foods and finally where the market is most price sensitive. The breakthrough achieved in the West in food processing and marketing will be a long time coming in the East, unless the vicious circle of low production, high costs, high prices and low scales can be broken.

9. REPORT ON IUNS CONFERENCE,
AT TUNIS (*JANUARY, 1971*)

C. G. King,
Institute of Nutrition Sciences,
Columbia University,
New York, N. Y. 10032,
U. S. A.

10. REPORT ON UNICEF SEMINAR ON
PRE-SCHOOL CHILDREN,
MADRAS, 1970.

V. B. Raju,
*Institute of Child Health,
Madras, India.*

11. DIETARY STUDIES AND EPIDEMIOLOGY OF HEART DISEASES

F. Fidanza,

*Institute of Food and Nutrition Science,
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Italy.*

The results of the International cooperative study on Cardiovascular Epidemiology will be reported here. In this prospective epidemiological study thirteen cohorts of seven countries (Finland, Greece, Italy, Japan, Netherland, U. S. A. and Yugoslavia) were examined. The ten-year follow up has been completed in most of the areas, but at this stage only data up to the five year follow up will be presented.

The calorie intake expressed per unit of body mass did not correlate either with serum cholesterol levels or with incidence of CHD. Also proteins, expressed as percentage of total calories, did not show any correlation with the same two parameters. The intake of fat calories, as percentage of total calories, was found to have a low correlation ($r=0.40$), but with different classes of fatty acids a significant correlation was observed between percentage of calories from saturated fatty acids and serum cholesterol level or the incidence of CHD ($r=0.84$). The percentage of calories derived from mono-ene fatty acids showed no correlation with serum cholesterol level but a low correlation with CHD incidence rate.

In the same way other nutrients as also few food-items will be considered.

12. THE PROBLEM OF LACTASE DEFICIENCY IN INDIA

Vinodini Reddy and Jitender Pershad,
*National Institute of Nutrition,
Hyderabad, India.*

A study was undertaken to determine the incidence of lactose intolerance, levels of intestinal lactase and the significance of lactase intolerance in relation to milk intolerance in a group of Indian adults and children.

Oral lactose tolerance tests were done in 18 normal adults. In 12 of them jejunal biopsy was also performed. The results showed that lactase activity was low in all the subjects studied but only half of them had symptoms of intolerance following the lactose load.

Lactose tolerance test was done in 54 normal children and jejunal biopsy was performed in 15 of them. Lactase activity was found to be normal in 9 out of 15 children. Twenty out of 54 children showed intolerance with a lactose load of 2 g/kg. but none of the 8 subjects in whom the test was repeated with a dose of 1 g. had such symptoms. Only 4 children had intolerance when skim milk containing an equivalent amount of lactose was given in divided doses.

Results of these studies show that the incidence of lactase deficiency and lactose intolerance is lower in children than in adults and that lactose intolerance does not necessarily imply milk intolerance.

13. CURRENT NUTRITION PROGRAMMES IN CEYLON

C. C. Mahendra,
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Colombo, Ceylon.*

Current nutrition programmes in Ceylon will be reviewed against the background of our major nutrition problems viz protein-calorie deficiency, associated with avitaminosis A, anaemia and endemic goitre.

The chief outlet for nutrition activities is through the maternity and child health services which have been recently re-organised under a separate department to intensify these activities. The measures adopted to reach the pre-school child and the problems peculiar to this group will be reviewed.

School children were kept under a scheme of continuous nutritional assessment from 1956, but this was suspended in 1965 pending a review and reorganisation of the project. The school lunch programme which commenced on a small scale in 1933 now covers the whole Island, and is kept under constant review. Present developments in this field will be discussed.

The role of the Medical Research Institute, agricultural extension services and voluntary organisation, training schemes for medical and paramedical personnel, the factors leading to the limited impact of nutrition education programmes and the need for more frequent evaluation schemes will be discussed.

14. RECENT PROGRAMMES FOR THE PROTECTION OF FOODS

S. K. Majumder,

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Gaps between population and availability of foods have been marginal in most of the developing countries of the world. This could be bridged by employing latest advances in the fields of infestation control and selective pesticides and protectants. In the perspective of the populations and status of food technology of these countries the requirements of storage structures, techniques of preventing biodeterioration, and food protection are discussed. Preventive sanitation by pre-harvest prophylaxis, pollution control by measures for reducing the populations of rodents, insects and fungi in processing plants and households and incorporating selective inhibitors for the pests in raw and processed foods are described for augmenting food resources. In addition to the problems of bulk foods, the data on storage aspects of protective and instant foods, and ready-to-serve packaged food products with special reference to quality are presented.

15. A PRACTICAL TISSUE TECHNIQUE FOR THE EARLY RECOGNITION OF PROTEIN- CALORIE MALNUTRITION

Robert B. Bradfield,
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U. S. A.

A tissue technique is suggested as a confirmatory test for the early recognition of protein-calorie malnutrition. It is of particular use in areas where children's ages are not known with precision and where laboratory facilities are not readily available. Hair roots are epilated from the occipital area, and the water-floated specimens are examined in a dissecting microscope under low power.

The ratio of anagens to telogens (growing phase to resting phase) is an indication of chronicity because the hair growth phase shifts completely to resting in chronic conditions. The mean root diameter is then determined of the bulbs in the growing phase, and the amount and degree of several morphological changes are also classified. These include the amount of obvious bulb atrophy, bulb depigmentation, and sheath miniskirting, fraying, and absence.

In nutritional status studies carried out with Negro children in the Caribbean, there were significant reductions in mean bulb diameter and in other bulb and sheath morphological characteristics in children with 75% weight-for-age. With decreasing weight for age, the signs were more marked and more prevalent. In studies of experimental protein deprivation of young adults in California, the hair root changes described became apparent by fourteen to seventeen days of depletion, approximately the same time that urinary nitrogen levels had plateaued. Total serum protein and albumin levels remained normal. The bulb characteristics described returned to normal with protein feeding. It is suggested that hair tissue is a sensitive and early indicator of protein-calorie malnutrition and offers a number of advantages over other biological specimens in terms of sampling procedures, storage of samples prior to examination, and equipment necessary to examine the specimens.

16. PREVENTION OF VITAMIN 'A' DEFICIENCY BY ADMINISTRATION OF MASSIVE DOSES OF VITAMIN-'A'

M. C. Swaminathan,
*National Institute of Nutrition,
Hyderabad,
India.*

The prevalence of ocular signs of hypovitaminosis-A is high among children and corneal involvement resulting in irreversible blindness is quite common among pre-school children. Ignorance, poverty and faulty dietary habits play an important role in the causation of this deficiency. Hence, in the long run, sustained efforts to deal with these determinants would seem to be preferable. Due to various reasons, the programmes, currently in operation to supplement vitamin-A to the needy population do not seem to be successful. The administration of a massive single dose of vitamin-A was considered as a possible short term method of controlling morbidity due to hypovitaminosis-A. Studies revealed that the oral administration of an oil soluble preparation of vitamin A palmitate was associated with a good hepatic storage of vitamin-A in experimental animals. The administration of a single dose of 300,000 units of such a preparation to pre-school children maintained serum level of vitamin-A at satisfactory levels for 6 months and at a lower but still above the predosing level even at the end of 12 months.

An investigation was undertaken among pre-school children in rural areas around Hyderabad, covering 23 villages to test the efficiency of such an approach. Conjunctival xerosis and Bitot spots were the most common ocular signs of vitamin-A deficiency, and the incidence was found to increase with age. The estimated dietary intake of vitamin-A mostly derived from vegetable food sources was about 200 I. U.

One thousand seven hundred and eighty five children between the ages of 1 and 5 years were administered orally a single dose of 300,000 I. U., annually till they reached the age group 5 to 6 years. The results indicate that about 80-90% of the children were protected from vitamin-A deficiency. It was concluded that the oral administration of a large dose of Vitamin-A once or preferably twice a year is a simple and effective measure capable of being implemented as a public health programme.

17. ORGANIZATION OF THE TRAINING OF MEDICAL PERSONNEL

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The key position of medical personnel in nutrition education activities in the community calls for an appropriate nutrition training of all the personnel employed by the community health services. Such training can be organized through (a) basic undergraduate education, (b) postgraduate training, (c) short-term in-service refresher courses and, (d) seminars.

The existing curricula for undergraduate students in the majority of medical schools do not pay due attention to education in nutrition and the long emphasized integration of nutrition into biochemistry, physiology, pediatrics, internal medicine, public health and other courses has rarely been achieved. If more nutrition is to be taught in medical schools the teachers themselves should first be introduced to the subject of nutrition, for the interest and motivation of the students is largely determined by the interest of the teacher. This can be achieved by (a) organizing nutrition courses for the teachers of physiology, biochemistry, pediatrics, internal medicine, and particularly public health at appropriate nutrition or public health institutes and (b) providing them with more financial support for nutritional research.

It was realized however that medical personnel by and large recognize the importance of public health activities including nutrition only when they join the community health services and start facing the practical problems themselves. Therefore the in-service training whether at the level of postgraduate training or as the relatively shorter refresher courses offers a good opportunity for introduction of nutrition

in the curricula for such training which should preferably be integrated with other aspects of public health activities.

The “nutritionally oriented” medical personnel is only one of the prerequisites required for launching a successful nutrition education programme in the community. Additional information on the relative importance of various ecological factors inherent in the development of malnutrition, and further the assessment of the “receptive capacity” of the community, depending on the economic and cultural level of the population, is needed before deciding on the magnitude and intensity of the programme. Such an analysis depends however on the assistance by a nutrition department within the country’s health services which has to be organized in a way so as to be able to provide technical guidance and training to the community health services.

18. PUBLIC HEALTH NUTRITION PROGRAMMES IN INDIA

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Government of India.*

Malnutrition is a multi-faceted problem and therefore requires multi-disciplinary approach. Nutritional status of an individual is closely linked with his health status, especially in relation to the vulnerable segments. As such, nutrition programmes within the over-all frame-work of health services will be an ideal approach towards the solution of malnutrition problem. Control of infection is an important pre-requisite for raising the nutritional standard of children belonging to lower socio-economic strata.

Unfortunately, the importance of nutrition programmes was not very much appreciated by the health administrator due to several administrative reasons. Usually, emphasis is always given on those measures which relate to the increase in food production. It is an accepted fact that malnutrition of the severest nature can and does exist in the midst of food affluency and such instances are quite common in all countries.

Government of India has taken a coordinated and comprehensive approach towards the problem of malnutrition and on this basis, the nutrition programmes during the 4th Plan have been devised. The public health nutrition programmes can be broadly divided under the following categories:

- a) Emergency programmes of short duration :
 - i) Prophylactic programmes against specific nutrition disorders of alarming nature e.g., Vitamin 'A' and iron deficiency.
 - ii) Supplementary feeding programme of vulnerable groups to prevent further deterioration in nutrition standards e.g., in protein calorie malnutrition.

- b) Permanent programmes against specific nutritional deficiency e.g. Goitre Control Programme.
- c) Long term programmes to create nutrition consciousness.
 - i) Through person to person approach in health agencies.
 - ii) Mass Communication through films.
- d) Permanent programmes for better screening and rehabilitation of nutritional disorders.
 - i) Upgrading and expanding health centres and allied agencies.
 - ii) Providing adequate number of trained personnel.
- e) Indirect measures through health agencies for raising nutritional standards.
 - i) Immunisation programme.
 - ii) Control of Family size.

The details and the methodology of these programmes will be discussed.

19. THE PROBLEM OF MARASMUS IN THE MIDDLE EAST

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Marasmus, scourge among infants in Europe during the last century, is now recognized as the major form of childhood malnutrition in Asia. Results will be presented of our experience of the problem over the past 8 years in Lebanon and Jordan including studies in the field, hospital wards, metabolic unit and laboratory.

In the field, various simple biochemical and anthropometric methods of defining marginal malnutrition have been assessed. Results with the mid-arm circumference head circumference ratio have proved most encouraging. The pathogenesis of protein-calorie malnutrition has been studied in relation to various socio-economic factors.

Studies on hospitalized patients with all types of protein calorie malnutrition provided information on the short-term prognosis, liver pathology and a simple scoring system for classification of the severe forms.

In the 10-bed metabolic unit in Beirut long term studies are being undertaken on mental development following recovery from marasmus, the effect of malnutrition on the immune response, the relationship between nitrogen balance, weight gain and protein-calorie intake and changes in somatic measurements during recovery from marasmus.

The major emphases of biochemical research at present are two. ^{15}N - labelled compounds (ammonia, urea, non-essential and essential amino acids, creatinine) have been used to gain a better understanding of the adaptive changes in nitrogen metabolism and the special requirements for amino acids in marasmus. Isoelectric focusing is being used to study the changes in carrier proteins (albumin, transferrin etc). that occur in protein-calorie malnutrition.

It is hoped that the free exchange of these and other experiences on the serious problem of marasmus in Asia will pave the way for a more concerted effort for its eradication.

20. NEUROLATHYRISM

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Lathyrism in man is a crippling disease characterised by spastic paralysis of the lower limbs and is known to be caused by the excessive and prolonged consumption of the pulse, *lathyrus sativus*. The recurrence of this disease is one of the public health problems in Central India. Studies in this Institute to elucidate this problem have been based on four major approaches; (a) Epidemiological and clinical (b) Experimental lathyrism in animals (c) Identification of the causative factors and (d) Prevention and control.

Epidemiological studies have revealed several interesting features of the disease in regard to the incidence in different age and sex groups. Clinical studies have shown a "latent form" besides established cases of this disease.

A major break-through in this problem arose from this Institute as a result of production of neurological symptoms in chicks by the administration of the pulse. This has led to the identification of the neurotoxic amino acid.

Since banning the crop is not feasible, some simple methods have been formulated for the removal of the toxin. These are steeping in hot water or parboiling. These methods are capable of being applied at a household or commercial level. Almost 90% of the toxin is removed by these methods without any major damage to the nutritive quality of the seeds. There is a wide variation in the concentration of the toxin in different varieties of the pulse. A genetic approach has thus emerged and it is now possible to selectively breed low-toxin strains of *L. sativus*.

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RESEARCH COMMUNICATIONS

1. SCOPE OF GENETIC AND AGRONOMIC ENRICHMENT OF CEREAL PROTEINS

A. Austin, H. D. Singh and V. K. Hanslas,

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In view of the importance of upgrading the quantity and quality of protein in the basic staple foods as the quickest and easiest way of combating undernutrition and malnutrition problems which are widespread particularly among children in many areas of the world, concerted attempts have been made at the Indian Agricultural Research Institute for a systematic examination of breeding materials of cereals and millets for high protein and high lysine. In 3785 strains of wheat from advance generation, the protein content varied from 9 to 23 per cent. The variability for protein was very marked. About 72 per cent of the new strains showed protein content ranging from 13 to 17 percent. Two hundred and thirty four promising strains which came out superior for protein and other agronomic characters were further screened for total lysine. About 46 per cent of these strains showed more than 13 per cent protein combined with more than 2.7 per cent lysine. The results in general offer possibilities of developing high protein *cum* high lysine varieties.

Similar possibilities have been observed in grain *Sorghum* (jowar) and pearl millet (*Pennisetum typhoides*)

In rice and maize the variability for protein was much less than that obtained in the other crops. In rice for example the protein content varied from 6 to 13%. About 64 per cent of the materials showed 6 to 9 per cent protein only.

Marked varietal differences for the content of protein and lysine in endosperm, embryo and pericarp of the maize grain were observed.

Scope of improving cereal proteins by agronomic practices has been further investigated.

2. ESSENTIAL AMINO ACID CONTENTS OF SOME NEWLY INTRODUCED VARIETIES OF WHEAT

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Out of the recently introduced high-yielding varieties of wheat the essential amino acid contents of 3 were determined and compared with the 2 local varieties which are considered good from the point of view of physical characteristics and protein contents. Physical characteristics like doughing has not been so good as the local varieties. However, from the nutritional point of view the proteins obviously are of utmost significance as wheat is the staple food of the bulk of the people in West Pakistan and contributes 80 per cent of the daily dietary intake.

Total protein content of the new varieties was slightly higher than the indigenous ones and varying from 11.7 to 12.4 per cent as compared to 11.3 to 11.4 per cent in the native varieties. The amino acid contents are given in the Table below.

AMOUNT IN (mg/100 g) OF WHOLE WHEAT

Variety	Phe	Met	Leu	Lys	Val	Ileu	Thr	Try
C273	656	271	814	215	508	520	328	136
C591	581	217	673	194	490	479	285	114
Mexi-Pak	620	211	714	164	456	433	246	105
Mangla	569	206	762	145	496	472	242	121
Norteno	570	198	657	136	422	423	260	99

In the above Table C273 and C591 are local varieties of wheat while Mexi-Pak, Mangla and Norteno are the newly introduced varieties.

It will be seen from the data on the whole the essential amino acid spectrum in the newly introduced varieties is not very much different from the native varieties although in some cases the quantity was slightly lower in the new varieties particularly as compared to C273 local variety.

In view of the exceptionally high yields of the new varieties it is suggested that their cultivation be further enhanced as far as possible, which, however, depends on the provision of more irrigation facilities and more fertilizers.

3. PRESENT RESEARCH EFFORTS TO
INCREASE RICE YIELDS

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4. THE PRESERVATION AND PROCESSING OF MILK AND MILK PRODUCTS

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Milk and milk products are among the most perishable of all the foods. They need to be preserved, otherwise spoilage occurs due to action of micro-organisms or due to the enzyme or chemical reaction.

The present methods of preservation of milk and milk products involve one or more of the general principles, of prevention of the entrance of micro-organisms, inhibition of growth and activity of micro-organisms and destruction of micro-organisms. On the basis of these general principles various methods such as asepsis, use of low temperatures, use of high temperatures, fermentation and drying have been employed in preservation of milk and milk products.

All over the world, market milk is preserved by the process of pasteurization and sterilization by application of heat. A recent development in processing of milk is, sterilization by Ultra High Temperature process with aseptic packaging. Such a milk needs no refrigeration and is called a "long life milk".

Milk products are manufactured from milk or cream for the purpose of preservation. Fermented milk such as *Dahi*, *Yoghurt*, *Kefir* and *Acidophilus* milk and most kinds of cheese are preserved by encouraging growth of lactic acid bacteria.

For the first time in India, modern methods of preservation and processing as applied to buffalo milk have been used in last two decades. In the present day civilization there is greater need for application of modern technology for preservation and processing of milk and milk products so that such a nutritive food could be shipped on a large scale from areas of abundance to countries where low nutritional standards prevail. In addition to other food constituents milk contains protein whose amino acids pattern is nearly as complete as those of egg and meat. Thus milk has become a very important tool in hands of nutritionists to use in supplementation of protein where it is necessary to improve the over all nutritive value of mix.

5. ROLE OF FISH PRODUCTS IN THE NUTRITION PROGRAMME IN INDIA

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The need for inclusion of liberal quantities of fish in Indian diet to improve the per capita animal protein intake in an effective and economical manner has been emphasized. Besides quality protein, Indian fishes are found to be good sources of fat, various vitamins and minerals like calcium, phosphorus, iron and copper. The muscles of fish and shell fish also abound in essential free amino acids. The body fat of fishes like *Sardinella longiceps* has been determined to contain pharmacologically important poly-unsaturated fatty acids $C_{20:5}$ and $C_{22:6}$. Qualitative and quantitative losses of nutritive factors in fish during preservation by icing and irradiation and processing into frozen, canned, dehydrated and smoked products have been evaluated and measures to minimise such losses briefly indicated. Large quantities of miscellaneous trash fish in our fish landings have been shown to lend themselves to profitable utilization into fish protein concentrate, fish paste and fermented products for human consumption.

6. BREEDING CEREALS AND PULSES FOR
HIGH PROTEIN CONTENT
AND QUALITY

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Preliminary studies made on the existing and induced variation for protein quality and quantity in various cereals and pulses have indicated a great scope for the genetic improvement in their nutritional quality. Emphasis has been laid on the improvement in the limiting amino acids lysine and methionine in cereals and pulses, respectively. In addition, gluten quality in wheat, milling quality in rice and cooking quality in pulses was determined. Fast, inexpensive and reliable analytical tests have been developed to suit the testing of plant breeder's material obtained from early generation.

7. HYBRIDIZATION AND PROTEIN QUALITY IN SORGHUM GRAIN

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Grain samples of crosses (F_1 and F_2) and backcrosses (BC_1) among eight varieties of sorghum grown in replicate at two locations, Delhi and Coimbatore, were analyzed for protein and lysine content. Protein content in the material obtained from Delhi was significantly more than that from Coimbatore indicating locational variation ($P \leq 0.01$). No such locational differences were seen in lysine content.

In both F_1 and F_2 population the protein content was significantly lower than that in parental population and also in the backcrosses. No hybrid vigour for protein was observed in the F_1 crosses. Backcrossing on to any one of the parents resulted in an increase in protein content as compared to protein in F_1 hybrids. In this process the protein value seemed to be restored to the level in parents.

Lysine content (g. 16 g. N) in parents, F_1 population and BC_1 population was statistically not significant. However, in F_2 population lysine was found to be significantly lower than that in parents alone. In 15 out of 40 F_1 hybrids lysine content was more than the best parent. The extent of heterosis observed was of the order of 0.5 to 21.0%. Hybrid vigour for lysine was observed in most of the F_1 crosses of IS 968 and IS 10202.

8. EFFECT OF AMINO ACID SUPPLEMENTATION ON
BIOLOGICAL VALUE AND NET PROTEIN UTILISA-
TION OF SOME VARIETIES OF MAIZE
AND GROUNDNUT

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And
C. S. I. R. O., Ryde, N. S. W., Australia.

The comparative quality of proteins in local maize (Ludhiana), Hybrid maize variety Illinoise 1656, groundnut varieties Punjab Groundnut No. 1, & 145/12-P was determined in terms of biological value (B.V.) & net protein utilisation (N.P.U.).

On test diets with 7% protein from local and hybrid maize, the biological values were found to be 65 & 55 respectively, and the NPU Values were 54 & 46. In the same experiment, the B.V. & N.P.U. values of a Casein control at 7% level were 74 & 62 respectively.

Supplementation of maize proteins with 0.8 per cent L-lysine lead to increase of B.V. from 65 to 72 in local and 56 to 68 in hybrid maize, when fed at 7 per cent level of protein. The N.P.U. Values increased from 53 to 60 in local maize and 45 to 58 in hybrid maize.

The B.V. of groundnut protein was found to be 60 for Punjab G.N. No. 1 and 58 for variety 145/12-P with 10.0 per cent level of protein in the diet. These values increased to 66 and 65 on supplementation with 0.1 per cent DL-methionine. The corresponding N.P.U. Values of these varieties were 52 and 49 respectively and they increased to 55 and 56 on supplementation.

9. NUTRITIONAL VALUE OF SOME NEW
RICE VARIETIES INTRODUCED
IN INDONESIA

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10. INFLUENCE OF GENETIC FACTOR ON THE
QUANTITY AND QUALITY OF PROTEINS
IN CEREALS AND PULSES

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In the past, maize of improved protein quality, has been developed genetically. The present work was, therefore, intended to study the genetic variability in the quantity and quality of proteins existing in different varieties of food grains so that such information could be an aid to a breeder for future improvement work.

The assessment of the quality of protein in cereals and pulses was based on the study of their limiting amino acids. The data obtained on different cereals (wheat, maize and sorghum) and pulses (*urd, mung, arhar, French bean, sem, peas and soyabeans*) reveal the existence of wide varietal differences in the amount of protein as well as in the limiting amino acids, such as lysine in cereals, and methionine in pulses, suggesting thereby that the genetic constitution of the seed has a pronounced effect on the quantity and quality of protein. There is thus a great scope for improving the quantity and quality of proteins through genetic manipulation.

11. CARBOHYDRATES IN HIGH YIELDING VARIETIES OF RICE

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Many high yielding varieties of rice have now been selected for large scale cultivation. The choice of these varieties has been governed not only by their high yield, but also by their nutritional quality. The emphasis on nutritional quality has, however, so far been on the protein content and the amino acid make up. Since rice constitutes the staple for a vast majority of the population, the nature of carbohydrates in rice and their digestibility also merit investigation. The amylose content and the starch-iodine blue value were determined in relation to the cooking quality of six rice varieties, i. e., IR-8, 'Jaya', 'Padma', 'Hamsa', TN-1 and B. C. 5. The results of such a study are presented here. Also, the rates of *in vitro* digestibility using α -amylase were measured. The significance of *in vitro* experiments were further tested *in vivo* in human subjects with two of the varieties which greatly differed in their *in vitro* rate of α -amylolysis.

The amylose content ranged from 15 to 22 per cent of the starch. The variety 'Hamsa' had the highest value while IR-8 had the lowest value. The rate of α -amylolysis of 'Hamsa' variety was the highest and that of IR-8 rice the lowest. Feeding trials using 'Hamsa' and IR-8 on human subjects indicated, that though a larger number of subjects showed higher blood glucose values with 'Hamsa' as compared to IR-8, these differences were not statistically significant.

1. METABOLISM AND BIOLOGICAL POTENCY OF β -APO-CAROTENALS

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β -Apo-carotenals, the oxidation products of β -carotene, are of significant importance in the colouration of food products. They are formed in small quantities in the animal system during feeding of β -carotene. The oxidation of β -carotene at the excentric positions, which are theoretically and chemically more susceptible to attack than the centre double bond, gives rise to different apo-carotenals.

A series of β -apo-carotenals were prepared by oxidation of a benzene solution of β -carotene with 30% hydrogen peroxide in the presence of 1.3% solution of potassium permanganate. The reaction mixture was chromatographed on 3% (v/w) water-deactivated alumina column and different β -apo-carotenals were eluted from the column by gradient chromatography. The different bands thus eluted were purified through MgO-Celite (1:1) column. Finally, the compounds were purified over 3% (v/w) water-deactivated alumina column. β -apo-8'-carotenal, β -apo-10'-carotenal, β -apo-12'-carotenal showed absorption maximum at 455, 437 and 414 nm, respectively. One new compound, with absorption maximum at 470 nm, was also obtained in 4-5% yield.

Bioassay experiments on rats taking β -carotene as a standard substance, showed relative biopotency of 31%, 76% and 44% for β -apo-8'-carotenal, β -apo-10'-carotenal and β -apo-12'-carotenal, respectively. The 470 nm compound showed biopotency of 38%. The different apo-carotenals alleviated vitamin-A deficiency symptoms and gave interestingly varying amounts of vitamin-A storage in the livers.

2. SERUM LOW DENSITY LIPOPROTEINS, TRIGLYCERIDES AND CHOLESTEROL LEVELS IN MALAYSIA

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The serum low density lipoproteins, triglycerides, cholesterol and total lipids have been determined for over 300 clinically healthy Malaysian subjects amongst whom were aborigines and blood donors of the Chinese, Indian and Malay race. These values were compared, whenever possible, with those obtained for 172 hospital patients with ischaemic heart disease.

In the sera of the healthy subjects, a rise in the serum lipids and the low density lipoproteins with age was apparent up to about 50 Years of age.

Although no ethnic difference was observed in the levels between donors, their mean serum cholesterol, triglycerides, total lipids and low density lipoproteins were significantly higher than the corresponding mean levels of the aborigines who in addition were relatively older.

Patients below the age of 40, had significantly higher mean serum cholesterol and lipoproteins than donors of the same age. But no significant difference was observed between their serum triglycerides at all age groups.

There is a good correlation between serum levels of cholesterol, triglycerides and lowdensity lipoproteins. It is suggested that the level of 600 mg% for the latter, corresponding to 250 mg% cholesterol and 220 mg% triglycerides (non-fasting), may be a useful indicator of potential hyperlipoproteinaemia in Malaysia.

3. PROTEIN STATUS AND TURNOVER RATES OF STORED H^3 -RETINOL IN RAT LIVER

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A single massive dose of vitamin-A reportedly prevents the occurrence of vitamin-A deficiency symptoms in children for long periods. In the present investigation, the storage efficiency and turnover rate of a massive dose of labeled vitamin-A has been assessed in rats fed optimal and minimal amounts of protein.

When overnight fasted rats were administered $15\mu c H^3$ -retinol and 30 mg unlabeled retinol by stomach tubing, it was observed that, in normal rats (20% casein diet), maximum storage in liver (75% of the dose) was reached at 24 hours and that 50% of the initial activity disappeared in 55 days; only 35% could be recovered after 70 days. However, in the low protein groups (8% and 3% casein), only 60% of the dose was stored in liver, but the rate of disappearance of the stored dose was significantly reduced. Although serum levels of H^3 -retinol were maintained more or less constant throughout the experimental period, the low protein groups always exhibited lower levels, in spite of relatively increased liver retinol levels. On chromatographic separation, radioactivity excreted in urine and faeces, recovered in the terminal fraction representing vitamin-A metabolites, was considerably less in the protein malnourished animals. This points to a block in the overall metabolism of vitamin-A in protein deficiency.

4. STUDIES ON VITAMIN-A METABOLISM IN CHILDREN

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Vitamin-A deficiency is a major public health problem among the children belonging to the poor sections of the population. One of the important causes for this widespread prevalence is the poor dietary intake of the vitamin. Repeated episodes of infection are frequently seen among these children, and there is little information regarding the role of infection in aggravating deficiency of vitamin-A.

Vitamin-A metabolism was therefore studied in five normal children and eight children with infection. About $4\mu\text{c}$ of 11,12- (^3H) -retinyl acetate along with 3000 I. U. of cold vitamin was administered orally. Total and fat-soluble (^3H) -excretion in urine and faeces was measured.

Less than 1% of the total administered label was found in the faeces of normal children indicating that the intestinal absorption of vitamin-A was complete. The radioactivity in urine was exclusively in the water-soluble fraction, accounting for 11 to 20% of the dose absorbed. In marked contrast, six out of the eight cases with infection had significantly higher excretion of label in faeces. Four of them also had increased excretion of the label in urine. These observations suggest that altered metabolism of vitamin-A brought about as a result of infection may adversely affect the vitamin-A nutritional status of children.

5. THE ROLE OF PROTEINS ON THE VITAMIN-D₃ TRANSPORT

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Vitamin-D₃ being insoluble in aqueous solution, the transport would take place in the associated form with some kind of proteins. Vitamin D₃ binding proteins (D₃-BP) were identified in rat plasma and intestinal mucosa by using gel filtration (Sephadex G-200), polyacrylamide gel disc electrophoresis and sucrose density gradient ultracentrifugation.

Vitamin D₃ binding activity was observed in several bands of plasma protein on the disc electrophoresis, and these proteins in 4.9—6.8 S fraction in sucrose density gradient ultracentrifugation. These proteins will participate in the vitamin D₃ transport in blood.

D₃-BP in cytoplasmic and nuclear fraction of rat intestinal mucosa were different from those in plasma. These proteins bind *in vitro* directly with vitamin D₃-1, 2-³H (2°C, pH 7.0). Cytoplasmic D₃-BP contained RNA, and nuclear D₃-BP RNA and DNA. Its sedimentation constant was calculated as about 10 S and 13 S respectively. However, in both cases the vitamin D₃ binding activity was not affected with equal amount of cholesterol, 17 β -estradiol and testosterone. In vitamin D₃ transport into the nuclei, it is necessary for the presence of cytoplasmic D₃-BP. D₃-BP of rat intestinal mucosa would participate in the intracellular traslocation of vitamin D₃.

6. THE EFFECTS OF LEUCINE AND ISOLEUCINE ON NIACINAMIDE NUCLEOTIDE SYNTHESIS

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Earlier work had demonstrated that administration of leucine brought about various effects on the metabolism of tryptophan and nicotinic acid. Leucine feeding brought about a reduction in the synthesis of niacinamide nucleotides. The role of isoleucine, if any, on this effect of leucine was studied.

The investigation was carried out in 3 sets of human volunteers. The first set received leucine alone for 5 days and leucine + isoleucine for 5 days more; the second received leucine for 10 days followed by leucine + isoleucine for 10 days and the last group received leucine for 15 days followed by leucine + isoleucine for 10 days.

Leucine administration brought about reduction in niacinamide nucleotides synthesis. Partition of nucleotides by paper chromatography indicated that only NAD (Niacinamide adenine dinucleotide) was synthesised during pre-leucine period. During periods of leucine administration measurable amounts of NMN (niacinamide mononucleotide) were synthesised.

Administration of isoleucine along with leucine for 5 days brought about an increase in the levels of synthesised nucleotides and at the end of 10 days, the levels were similar to the levels synthesised on the basal diet alone. Partition of synthesised nucleotides suggested that there was no synthesis of NMN at the end of 5 days of isoleucine + leucine administration.

7. EFFECT OF ASCORBIC ACID ON IRON ABSORPTION BY SOUTH INDIAN COLLEGE WOMEN FED ON AN EXPERIMENTAL HOSTEL DIET

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An attempt was made to study the effect of ascorbic acid intake on iron absorption using South Indian College Women as subjects. A preliminary study of the hostel diet was conducted to estimate the iron balance of five subjects, consuming the hostel diet for two three-day periods. The average iron intake was 21.44 mg. per day and the faecal excretion ranged from 70.8 to 82.27% of the amount ingested.

An experimental diet using the kind of food-stuffs present in the hostel diet was planned with two menus. The experimental period was sixteen days. During the first half of this period, the subjects received, on an average, 13.87 mg. of iron estimated chemically and 88.0 mg. of ascorbic acid (calculated) in their diet per day. The absorption of iron was found to be 2.22 mg. During the second half of the period, the subjects were given 100 mg. of ascorbic acid in the form of Vitamin-C tablets, while the intake of iron was maintained at 13.87 mg. (same level). All except one subject were in positive balance. The average absorption of iron in this period was 4.57 mg. indicating a definite increase in absorption which was statistically significant at one per cent level ($P < 0.01$).

8. POSSIBLE INFLUENCE OF TESTICULAR HORMONE
ON KIDNEY PYRIDOXINE METABOLISM

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The effects of castration and administration of testicular hormone on pyridoxine metabolism in kidney have been studied in male albino rats. Castration has been found to lower the pyridoxal phosphate concentration of kidney. Administration of testosterone to castrated rats restored the pyridoxal phosphate level of kidney, while normal rats showed increased kidney pyridoxal phosphate level upon treatment with testosterone. Decreased pyridoxal phosphate concentration in kidney following castration was found to be associated with diminished kidney pyridoxine phosphate oxidase activity. Castrated rats upon receiving testosterone showed normal pyridoxine phosphate oxidase activity in kidney, while the same treatment enhances the pyridoxine phosphate oxidase activity in kidney of normal rats. Neither castration nor administration of testosterone seems to have an effect on pyridoxal kinase activity in kidney. It has been suggested that testosterone controls the pyridoxal phosphate formation in kidney by regulating the kidney pyridoxine phosphate oxidase activity.

9. ASCORBIC ACID DEGRADATION AND
CATALASE ACTIVITY IN THE LIVER
OF COLD-ADAPTED FROGS

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L-Ascorbic acid (ASA) and diketo-gulonic acid (DKA) levels were decreased in the liver of frog on cold-adaptation, whereas dehydroascorbic acid (DHA) level remained unaltered. Contrary to this, ASA level increased, whereas DHA and DKA levels decreased in the serum on cold-adaptation. Both the thermal categories of frogs were force-fed on earthworms and fresh water mussel slices on alternate days. These results show the occurrence of permeability changes of liver cells on cold-adaptation toward storage or synthesis or transport of ASA. Since ASA is known to accelerate or inhibit certain enzymatic activities, these changes may have some physiological significance. On 2.5% agar gels after high voltage electrophoresis, the liver catalase from both warm and cold-adapted frogs exhibited differential electro-mobilities; in that the enzyme from warm-adapted frogs moves at a faster rate. These studies further revealed that these two enzymes have different-Michaelis-Menten kinetics. The enzyme from warm-adapted frogs was inhibited by the substrate in contrast to that from cold-adapted ones. Besides, manometric studies revealed that the addition of ASA at the physiological concentration to the assay medium caused inhibition of catalase activity; the extent of which was greater in the warm-adapted frogs. Protein synthesis is known to increase on cold-adaptation. Decrease in ASA content in the liver of cold adapted frogs compensates with the synthesis of catalase which shows less ASA inhibition and no substrate inhibition. In view of the changes in flavin metabolism on cold-adaptation, it is suggested that there must be greater demands on catalase to detoxify the resultant peroxides, which are met by the synthesis of catalase. Concomitant to this, the changing levels of ASA may be among the molecular compensatory mechanisms of cold-adaptation, in the spectrum of which the catalase functions.

10. IMPORTANCE OF CAROTENOID CLEAVAGE ENZYME IN VITAMIN A NUTRITION

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Carotenoid cleavage enzyme plays a pivotal role in the conversion of various carotenoids which are exclusively plant and microbial isoprenoid compounds into vitamin A which is so very essential for animal nutrition. It is only the animal organism so far known that is capable of bringing about this transformation and naturally it was of interest to investigate the carotenoid cleavage enzyme in various species in an attempt to correlate with their nutritional requirement of vitamin A.

The present report describes the specificity of carotenoid cleavage enzyme from the intestinal mucosa of guinea-pig, rabbit, tortoise, monkey, fresh water fish, chicken and cat towards β -carotene and β -apo-10'-carotenol. Universal distribution of the enzyme in various species is a clear indication of the importance of this enzyme for animal life and growth. The only notable exception is the cat which showed virtually no activity. The enzyme is seemingly specific for 15-15' double bond of carotenoids no matter from which species it is isolated. At the same time, it is relatively non specific so far as the length of the isoprenoid chain is concerned. Guinea-pig and rabbit showed the maximal specific activity followed by tortoise, fresh water fish, monkey and chicken. The cat, on the other hand, showed no activity.

Significance of these findings with special reference to vitamin A nutrition in animals will be discussed.

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11. VITAMIN-A DEFICIENCY IN FAMINE CAMPS

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Famine provides an excellent opportunity to study the nutritional deficiency disorders in human population. Diets in famine relief camps are grossly inadequate in nutrients specially with regards to vitamins. Vitamin-A deficiency is quite frequent in such population and is the most important cause of preventable blindness in India. A clinical appraisal of vitamin-A nutritional status was carried out during medical aid operation in famine relief camps in Northwest part of Rajasthan.

From 12 famine relief camps 5346 persons of either sex and different age groups were examined for vitamin-A deficiency signs. As many as 16.12% (862) people were having one or more signs of vitamin-A deficiency. Night blindness was the commonest complaint (85.5%) in the cases examined. The other signs in the order of frequency were Bitot's spot (58.8%), Conjunctival xerosis (15.01%), Skin xerosis (17.4%), Corneal xerosis (15.43%), Keratomalacia (1.74%) and Follicular hyperkeratosis type 1 (0.8%).

Pregnant women and school children were the main victims to suffer. In all the cases vitamin A was given orally with butter fat in doses ranging from 50,000 to 300,000 I. U. according to severity of the lesion. Hemeralopia was cured within a week in all but 22 cases in which the dose was repeated on 7th day.

1. SCHOOL LUNCH PROGRAMMES IN CEYLON

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INTRODUCTION :

Children malnourished during active period of growth & physical development will not grow into healthy adults. Malnutrition affects not only their health but also their capacity to learn. The midday meal is of vital importance to majority of school children in Ceylon and the Govt. has recognised the principle of supplementary feeding of the school children.

Upto 1968 the free mid-day meal consisted of a bun ($2\frac{1}{2}$ Ozs) and $\frac{1}{2}$ pint of milk from 1 oz. of skimmed milk. Animal protein and specific nutrients like Calcium and Riboflavin were thus supplied. Thereafter biscuits replaced the bun.

DEFECTS :

Fat and Vitamin A not supplied.

For an underweight child calories are insufficient.

All the children do not take milk.

PROPOSALS FOR IMPROVING NUTRITION :

- a. Grading of schools nutritionally.
- b. Selection of appropriate meal.
- c. Health Education in Nutrition.
- d. School gardens.

2. EVALUATION OF PROTEIN BISCUITS AS NUTRITIONAL SUPPLEMENT TO SCHOOL CHILDREN—A PILOT STUDY

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The importance and need for good nutrition during early childhood are universally accepted. In a developing country such as India where malnutrition is rampant, some form of dietary supplementation is essential.

Because of the high nutritional value and economic importance, soyabean would be a promising food for supplementation. Soyabean has disadvantages such as poor taste and presence of antinutritional factors such as trypsin inhibitor. These were overcome, and soya-based and groundnut-based biscuits were manufactured by a local food factory in Poona.

The efficiency of these biscuits was evaluated in a pilot study in 116 school children, from poor families in Poona. Each child was given a supplement of 4 biscuits, each giving 1.25 gm. protein and 35 calories. Children receiving biscuits for more than 41 days showed in 3 months a significantly higher weight (average 0.35 kg) and height (average 1.85 cm.) gains than the control group. The results did not reveal significant differences between the groups fed soya or groundnut biscuits. Trypsin inhibitor in soya-biscuits was destroyed in the manufacturing process.

The use of high calorie biscuit, is strongly recommended in the school feeding programme.

3. FAILURE OF A MASSIVE ORAL DOSE TO PROTECT PRE-SCHOOL CHILDREN FROM VITAMIN-A DEFICIENCY.

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Large oral doses of vitamin-A palmitate (100,000 mcg and 50,000 mcg) were given to normal pre-school children resident in an orphanage. Their serum levels and those of the controls were estimated frequently. The children were maintained on recommended intakes of protein and calories. The vitamin-A content of the diet, as carotene, was similar to that of pre-school children in Tamil Nadu.

Following 100,000 mcg vitamin-A, serum levels of the children were higher than those of the controls for 13 weeks. On repeating the experiment serum levels dropped between 15-19 weeks.

Following 50,000 mcg of vitamin-A, levels indicative of deficiency were observed from 14-16 weeks after the dose. By 18 weeks, statistically significant differences between the two groups were not encountered. Two children who were given the dose showed xerosis and Bitot's spots after the 10th week.

Oral doses of vitamin-A, of the magnitude stated above, were ineffective in preventing deficiency in pre-school children for more than 13-18 weeks.

4. PROTEIN INTOLERANCE IN NEWBORNS AND INFANCY

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This is a study of 20 newborns and infants who were on high protein diet. The clinical picture consisted of increased appetite, excessive crying, abdominal distension and failure to gain weight inspite of high intake of calories, often upto 250-300 calories per kg per day. They also had tachypnoea, tachycardia, marked abdominal distension, and polyuria. It was found on analysis of the diet, that the babies consumed a large amount of protein in the milk. The symptomatology of the present condition and of carbohydrate malnutrition described by us and the milk injuries (Melharsaden) described by German authors are similar. However, these children did not have carbohydrate malnutrition as they were taking adequate amount of carbohydrates in the diet. Treatment consisted of reduction of proteins in the diet. The babies improved with reduction of protein from 10-12g/kg to 4g/kg. They gained weight inspite of reduction of total calories to 120-140 per kg from pre-treatment intake of 250-300 per kg, per day, and gradually other symptoms regressed.

5. A BALANCED APPROACH TO CHILD NUTRITION

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A study of Comparative Constitutional Law reveals that few nations of the world have included in the articles of their Constitutions, any provision or basic right which guarantees their populations minimum nutritional sustenance. And yet, there are few areas of human activity or concern which parallel the need and search for adequate food; adequate food, principally in terms of quantity. Given the obvious lack of importance attached to national nutrition as reflected by the conspicuous absence of any mention of nutrition in most constitutions, it has been necessary for scientists and of late, planners, to establish nutrition in its rightful place and in the spectrum of national priorities, either by legislative act or executive order.

There is a slow but growing sense of awareness that nutrition is inexorably linked with not only the physical, but also the intellectual development of children, and ultimately the nation. Development Economics, in theory and practice, has been rudely neglectful of nutrition as a factor in the development equation. Illusive yardsticks such as per capita income, gross national income, and gross incremental output ratio, have been used over the past 25 years to measure the health of national economies. No one has bothered to measure and value mortality rates or morbidity rates, as reflected in the cost of hospitalization, curative out-patient treatment, the cost of drugs and medicines and the over-all drain on the economy. This is unfortunate for such measuring devices may require us to drastically reverse national priorities.

6. A SURVEY OF DENTAL AND GINGIVAL CONDITIONS AMONG SCHOOL CHILDREN IN SUNDERPUR, VARANASI

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A Survey of dental and gingival condition among school children was undertaken with emphasis on dental caries. In all 400 children belonging to 6-17 year age group were examined. The analysis revealed:

1. Among 400 children 233 were non-vegetarians and 167 vegetarians with 77 and 57 cases of caries ($X^2 = 0.26$, $P < 0.50$).

2. The overall incidence of caries was 34.0%. Incidence was high in students who ate sweets frequently ($X^2 = 22.80$, $P < 0.001$, highly significant).

3. Maximum incidence was in 6-7 yr. age group with a predilection for molars. 17.5% children had hyperplastic gingivitis and 3.25% had pockets.

4. 67% people were using datoon, 23.5% fingers only, 6% both powder and abaratives, and 3.5% tooth brush for cleaning teeth.

Fluoride content of the water could not be determined due to non-availability of laboratory facilities.

The above study attempts to define the extent of caries in a slum, harbouring people of lower socio-economic group. The authors have suggested that for areas where fluoridation is not possible the only therapy is intensive nutrition education & oral hygiene as part of total health care.

**7. HEMATOLOGIC VALUES OF BLOOD SAMPLES
OF PREGNANT AND NON-PREGNANT
WOMEN IN UBOBAJTANI**

R. Vachananda,
Bangkok, Thailand.

8. AN EPIDEMIOLOGICAL STUDY OF NUTRITIONAL DISORDERS IN CHILDREN BELOW 5 YEARS OF AGE IN KALYANPUR.

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401 children between 0-5 years age were selected randomly from the two diverse communities. 202 children were drawn from the villages of a Rural Field Training Centre, and 199 from the campus of Indian Institute of Technology.

Though single families formed the bulk of study in both the communities, joint families were more in villages. 21.11 per cent of the children in I. I. T. were in age group 6-12 months, while in villages 36.82 per cent were in age group 1-2 years. Males were in preponderance at both the places.

30.22 per cent of the children in villages manifested nutritional disorders in comparison to 9.55 per cent from I. I. T. Anaemia was present in 11.32 per cent in villages and only in 7.04 per cent in I. I. T. Vitamin deficiencies were observed 8.9 per cent in villages and 1.5 per cent in I. I. T. Vitamins A and B deficiencies were prominently seen in villages. Protein-calorie malnutrition was noticed in 1.98 per cent of the children in villages and in 0.50 per cent in I. I. T.

Nutritional disorders were not seen in children below 3 months of age. The disorders dominated in villages after 1 year of age while in I. I. T. it was seen after 2 years. Nutritional disorders were seen mainly in social class III (11.9 per cent) in I. I. T. and social class IV (24.71 per cent) in villages.

Maximum nutritional disorders were seen in vegetarians, and the occurrence was 6.53 and 20.29 per cent in such families of I. I. T. and villages respectively. The disorders in single families were 6.03 and 17.08 per cent in I. I. T. and villages. Children of 2nd birth orders had maximum nutritional disorders of 10.89 per cent in villages. In I. I. T. maximum disorders (3.01 per cent) were seen in 3rd birth order. Past morbidity for other devitalising diseases was seen more in villages.

9. APPLICATION OF SOME BIOCHEMICAL
METHODS IN DIAGNOSIS OF NUTRI-
TIONAL DEFICIENCIES

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In this study, 750 pre-school children (1-5 yrs.) from urban and rural communities were selected for anthropometric measurements, clinical and dietary assessment. Every third child was investigated for biochemical values in blood. The data on incidence of anaemia, protein-calorie malnutrition, vitamin deficiencies will be discussed. These subjects have also been studied for evaluation of dispensible to indispensable amino acid ratios suggested by Whitehead and Bjornesjo in plasma and erythrocytes. It was demonstrated that fall in leucocytic free amino acids is the first to appear and consistent in protein deficiency. This was convincingly further demonstrated in pregnant women taken as a model of growing hypoproteinaemia.

10. INCIDENCE OF PROTEIN-CALORIE MALNUTRITION IN THAILAND

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Protein-calorie malnutrition is recognized as a major nutritional problem in the under-privileged segment of the world population. In Thailand, while the food products are rich, there are frequently nutritional deficiency diseases occurring especially in the North-East.

The improvement of protein intakes of the population, both quantitatively and qualitatively, can possibly be done by the use of protein-rich supplementary foods

One of the best means tried so far to reach the pre-school children and their mothers is to organize a community day—care centre or Child Nutrition Centre. The people are invited to participate in the organization. This arrangement will enable simultaneous education of the mothers and feeding of children. The Child Nutrition Centre will be carried on by the midwives or health nurses.

The Government of Thailand, recognizing the importance of the problem, has undertaken to supply corrective measures by promoting the agricultural industry and increasing the quantity of food, among which is the programme to develop protein-rich foods utilizing local raw materials. From this programme the Protein Food Development Project was established. Begun in 1969, this project has good co-operation of the scientists and related officers in the Institute of Food Research and Products Development, Kasetsart University, and Nutrition Division, Department of Health, Ministry of Public Health.

11. EVALUATION OF AN APPLIED NUTRITION PROJECT FOR COMBATING PROTEIN CALORIE MALNUTRITION

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Protein Calorie Malnutrition is a major public health problem of pre-school children in our country. From the numerous surveys carried out in South India, the prevalence of protein calorie malnutrition in South India is about 1-2%. The solution to the problem obviously cannot lie in the treatment of such cases, but in its control and prevention.

A practical action programme of supplementary feeding of pre-school children in 2 villages, Kuntloor and Koheda, was started about two years back, the supplement being based exclusively on local resources. The community has been actively involved in all phases of the programme, viz. from the stage of procurement of foodstuffs to that of distribution of foods to the children. Thus, a considerable cost in transportation and distribution of food is avoided and the community is involved in all stages of the programme.

A study was undertaken to evaluate this supplementary feeding programme.

The nutritional status and dietary standards of this group of children were evaluated through (i) clinical nutritional surveys, (ii) anthropometric survey and (iii) diet survey. The results are compared with similar studies carried out on a control group of children from neighbouring villages.

12. INDUSTRIAL NUTRITION : SOME OBSERVATIONS ON CANTEENS IN INDUSTRY

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It is rightly said that what the industry can get out of the worker depends very much on what it puts into him. An industrial worker is one of the vital functionaries in the cycle of production and development of the industry and deserves assistance in every way to maintain his health to ensure optimum output. With India's rapid industrial expansion, the importance of adopting measures to improve the nutrition of the workers is engaging attention of the Governments and gradually inducing the progressive managements also to give an active support to the feeding.

As part of the welfare measures for the industrial workers the Factories Act (1948) of the Govt. of India lays down establishment of canteens in industry employing 250 workers or more, with the object of making wholesome food available to the workers within the factory premises, at reasonable rates. However how many managements have followed the real object of the canteen provisions?

At present there is a big gap between what is considered an adequate meal for the worker and what is actually served through majority of the canteens. Although the caloric needs are often met, the major deficiencies usually observed are in respect of some of the important nutrients like vitamins A & C, calcium, and good quality proteins. Moreover, the escalating prices and the chronic deficit of foods, the ignorance in food values of the persons responsible for planning and preparing the food, limit the maximum benefit that could be derived from foods for nutritional well-being.

The problem of providing nutritionally adequate meals and snacks acceptable to the palate of the cosmopolitan group of workers, such as in India, is no easy task and needs sustained efforts on the part of all concerned. The education of the workers themselves in proper selection of snacks and meal items is of no less importance. The effects of well-planned meal service through industrial canteens could be far reaching if the workers are made to realise the relative importance of foods for health.

13. CALORIE INTAKE OF PRE-SCHOOL CHILDREN WHEN FED *AD LIBITUM*

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Accurate and reliable diet survey data on the pre-school children in several parts of India have indicated that the main bottleneck in their current dietaries is calorie insufficiency. The NDp Cals % of the diets of pre-school children in the various regions of India range from 4.8 to 8.8. These must be considered adequate on the basis of recommended protein allowances by WHO/FAO and ICMR Expert Group. The protein deficiency that exists in these communities may, therefore, be considered as being conditioned by calorie inadequacy. It may, therefore, be argued that if the children consumed increased amounts of the type of food they are already consuming in quantities sufficient to meet the calorie requirements, a considerable impact could be made on the incidence of protein-calorie malnutrition in this country. Doubts have, however, been raised whether the bulk of the food would permit the children to consume it in adequate amounts.

A study was, therefore, conducted on 14 children aged between 2 and 3 years living in a rural area near Hyderabad. Two diets patterned on their home diet were fed *ad lib* to the children four times a day. The first diet was based on rice, pulse and skimmed milk (NDp Cals 6.5%) and the second on rice, pulse and peanut (NDp Cals 5.5%). The first diet was fed for 15 days, followed by the second for 10 days.

The results showed that all the children were able to consume 1000 or more calories per day, the mean intake on the basis of body weight being 112 Kcal/kg. body weight. The food intake of children who were still being breast-fed was less than that of the groups not breastfed, but the total calorie intakes were similar when calories derived from breastmilk were taken into consideration.

These results suggest that pre-school children can consume their existing diets in amounts sufficient to satisfy their calorie needs, provided the food is offered to them frequently in small amounts.

14. ECONOMICS OF FOOD CONSUMPTION OF RURAL AND URBAN POPULATION

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Food consumption surveys were conducted to study how money was spent on food. Two regional groups—Maharastrian (M) and Gujarati (G) were included in the urban survey. Most of the urban families lived in two room apartments. The rural families (R) consisted of agriculturists with a land holding of three acres or less. All figures reported are paise spent per day per consumption unit (C.U).

The (M) and (G) families spent Rs. 1.84 and Rs. 1.70 respectively for food. The rural families consumed the rice they produced and spent 33 paise for all other foods. The (M) and (G) families spent 25 and 20 paise for cereals respectively.

Negligible quantities of milk was consumed by the (R) families. The (M) and (G) families spent 71 and 56 paise respectively on milk.

The (R) families spent 8 paise on fish. The (M) and (G) families did not eat fish.

The (R) families spent 5 paise on pulses, the (M) families 9 and the (G) families 10 paise.

The (R) families did not buy fruits. The (M) and (G) families spent 4 paise each on vitamin C rich fruits and 8 and 5 paise respectively on other fruits.

The (R) families spent 6 paise on fats and oils, the (M) families 27 and the (G) families 34 paise.

The (R) families spent 2 paise, the (M) families 4 and the (G) families 3 paise on leafy vegetables.

The (R) families spent 7 paise on jaggery. The (M) and (G) families spent 13 paise each for sugar and jaggery.

The (M) and (G) families spent 11 paise each on ready-made foods. The (R) families did not buy any.

15. BERI-BERI IN THAILAND

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It has long been known that beri-beri is a nutritional disease due to deficiency of thiamine (vitamin-B₁).

Thailand is an agricultural country. It is divided into four parts, North, South, Central and North-East. In each part of Thailand, eating habits and economic status of populations are quite different. Present Thailand population is estimated to be thirty three millions. Eighty per cent of the people live in rural area, and almost all earn their livelihood through agriculture. Beri-Beri cases were found to have relationship with substitution of home pounded rice with highly milled rice. The old fashioned Thai-farmer of a few decades ago, who milled the rice himself, had a better supply of thiamine (0.12 mg/ 100 g edible portion); so the incidence of beri-beri was less. After the World War II, the disease seemed to have increased in some parts of Thailand, especially, in the North and the North-East. That is probably due to the introduction of modern rice mills which made highly polished rice, devoid of thiamine, to the people. But through health education and widespread use of synthetic thiamine, obvious cases of beri-beri in adults and children have not been seen as often as some decades ago.

16. PROGRAMMES TO MEET THE PROBLEM OF VITAMIN-A DEFICIENCY IN INDONESIA

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In Indonesia as in other developing countries, vitamin A deficiency is still an important problem with a very high incidence rate in small children.

Vitamin A, because of its relation to growth and implication in xerophthalmia, is particularly important in the young children, and in Indonesia, primary deficiency caused by inadequate intake of the vitamin or of carotene is the largest single cause of blindness.

As in other developing countries, socioeconomic condition is the most important problem to solve, but until now such programmes are still not available in Indonesia. Common efforts which we still use in Indonesia for the prevention of vitamin A deficiency are :

1. THE SHORT TERM PROGRAMMES :

Plans directed toward improvement of vitamin A intake in pre-school age:

- a. To give information, education and demonstration about foods rich in vitamin A or carotenes.
- b. Distribution of foods rich in vitamin A / carotenes.
- c. Distribution of vitamin A preparations.
- d. Combating ascariasis and other infectious diseases in children.

2. THE LONG TERM PROGRAMMES :

The attention of the Governments / National authorities should be drawn to the importance of planning for better food supplies for the people with the assistance of FAO / WHO and UNICEF participations.

1. DEVELOPMENT OF WEANING FOODS IN CEYLON

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Data collected during the course of a 10 year study of the levels and rates of growth of nearly 20,000 children from birth to six years of age, in eight rural and two urban areas in Ceylon, reveal the urgent and widespread need for an adequate diet at the time of weaning. The absence of any traditional methods of weaning and the fact that a large section of the rural and urban population belongs to the low income group makes it necessary that the weaning food should be cheap and easy to use.

The problems of manufacture of a "National weaning food" and its formulation with specific reference to protein levels, protein quality, calorie density and the levels of fat, minerals and vitamins will be reviewed. The form of manufactured products and cost of production will also be discussed.

2. AFLATOXIN CONTAMINATION OF FOODS AND ITS SIGNIFICANCE IN THE AETIOLOGY OF INDIAN CHILDHOOD CIRRHOSIS

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A limited survey of several common items of food has indicated the presence of significant quantities of aflatoxin. By virtue of its heat stability at normal cooking temperatures, the ingestion of aflatoxin along with the food becomes almost inescapable under the existing conditions. It is, therefore, clear that children (particularly after the weaning stage) also consume such foods and get exposed to aflatoxin. During the course of a study extending over a period of five years, and covering nearly 250 cases of healthy, cirrhotic and kwashiorkor children, adequate evidence has been collected to suggest that aflatoxin is involved in the aetiology of Indian childhood cirrhosis.

3. RECENT DEVELOPMENTS IN THE DEGOS- SYPOLISATION OF COTTONSEED PROTEIN

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Cottonseed contains protein along with oil and gossypol in glands. While the deoiling is rather easy, the gossypol separation from cottonseed protein is rather difficult. Since the toxic component can bind with lysine thus reducing the protein quality, any method of degossypolisation can leave behind different levels of free and bound gossypol. The earliest method consisted of partly binding gossypol with protein and obtain a protein product, nutritionally satisfactory.

However, recent developments in the gossypol removal follow different approaches. The three new developments in these approaches are, (i) prepress solvent extraction using conventional hexane solvent (ii) direct extraction using aqueous solvents, & (iii) direct extraction using hexane for deoiling, followed by gossypol gland fractionation for recovery of proteins.

4. TRADITIONAL METHODS OF FOOD PROCESSING FOR INFANTS IN PAPUA-NEW GUINEA

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Papua-New Guinea is one of the most rugged countries in the world due to high mountain ranges that extend from one end to the other end of the island. Therefore, there are many tribes which are isolated from each other and each has its own traditional methods of food processing for infants.

Breast feeding is the only method, that is given to every infant 2 days after delivery till they passed the infancy stage. This will apply to every tribe whether it is in the villages, hamlets and hills.

Breast feeding is followed by a diet of sago-jelly, sweet potatoes, papaya, pumpkin, fish and meat, and these are started as early as 2 weeks in some districts of the country.

Methods of food processing consist of "Mu-Mu" boiling and cooking on fire and the prepared food is given either pre-masticated by one of the parents or as a small portion, when the infant has teeth.

5. NUTRITIONAL STUDIES ON VEGETABLE TONED MILK—MILTONE

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A process using protein isolated from groundnut in toning of milk has been standardised. The vegetable toned milk obtained from this process (Miltone) has all the desirable characteristics of milk. Miltone is being produced in Bangalore to the extent of 1,000 litres per day.

The nutritive value of Miltone is altered to a great extent by the conditions of processing. Control of aflatoxin levels in Miltone is of paramount importance since the edible groundnut flour used has usually some aflatoxin content. It is possible either to reduce this to the limits prescribed by Protein Advisory Group (PAG) by removal of the fungus-affected seeds or to destroy the aflatoxin in the protein liquor by treating it with hydrogen peroxide. Both the methods have been employed in the process. The Protein Efficiency Ratio (PER) of optimally processed Miltone was 2.4. But when treated with hydrogen peroxide for the removal of aflatoxin the PER was reduced to 1.9 indicating the deleterious effect of treatment with an oxidizing agent. Other processing steps also have considerable effect on the nutritive value. When Miltone was made into lactic curds, the PER was increased to 2.7. Sterilisation of Miltone brought about a slight lowering of the PER (2.2). The NPU (Net protein utilization) value of Miltone and Miltone curd were 60.7 and 62.3 respectively. Miltone has also been used for feeding children in the age group 6-8 months.

6. DEVELOPMENT OF A WEANING FOOD BASED
ON "SHATI" (CURCUMA ZEDORIA ROSC)

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A composite food was prepared by blending shati "palo" with precooked dehydrated black gram pulse (*Phaseolus mungo*), carrot (*Daucus carota*) and amla (*Phyllanthus emblica*) in proper proportions to make it adequately balanced with regard to calorie, protein, vitamins and minerals.

Three groups of rats were fed 3 diets at 10% protein level; A-having the composite food, B-composite food supplemented with milk powder and C-standard casein diet. The PER values for the 3 diets were 2.37, 2.49 and 2.93 respectively. Overall digestibilities were 84.13%, 85.4% and 93.4% and protein digestibilities, 79.6%, 76.4% and 87.6% respectively. The liver lipid contents of the 3 groups of animals were 3.33%, 4.25% and 4.43% respectively. The group of rats fed composite diet had good growth and healthy appearance, but developed distended abdomens. No abnormal pathological changes were observed in the livers of the 3 groups of rats.

7. BROWNING OF CHAPATTIES

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One of the attributes which makes the recently introduced dwarf wheats less acceptable to the consumer is that *Chapatties* made from them are brownish in colour. Experiments to elucidate the biochemical causative factors reveal that besides the grain coat colour, (in the case of reddish grain coat varieties) which cause immediate browning of dough and *Chapatties*, high tyrosinase (phenol oxidase) activity in dwarf wheats is responsible for dough darkening and subsequent browning of *Chapatties*. The reaction involves oxidation of phenols and some amino acids to quinones which polymerize and interact with protein to form complex products. The rate of dough darkening is determined by the release of free phenols from phenolic glycosides by the activity of the enzyme, β glycosidase, and their subsequent oxidation in the presence of tyrosinase.

8. THE EFFECT OF PROCESSING OPERATIONS AND COOKING ON THE THIAMINE, RIBOFLAVIN AND NICOTINIC ACID CONTENT OF SOME EGYPTIAN NATIONAL FOODS

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The vitamins were determined following each of the processing operations and cooking to which 5 food items are subjected.

Flour, bread, beans, rice and sesame products were chosen on their merits as the chief sources for calories, protein, and the B-complex vitamins particularly for low income Egyptians.

Flour & Bread: Extractions (100, 91, 87.5, and 72%) of Egyptian wheat flour (Variety Hindy), dough fermentation, baking and toasting of Egyptian bread.

Broad Beans: Green pods, raw or stewed; dry pods after water soaking are slowly baked with water under pressure (baked beans), sprouted and cooked in water (Nabet) or decorticated and the ground meal is mixed with greens and spices to soft paste which is subjected to short cooking (Bisara), or oil-fried as small cakes (Taemia).

Rice: Brown partially polished containing germ, polished and parboiled polished rice. Washing is followed by heating with water until soft.

Sesame products: Sesame butter (Tahina) is produced by water soaking of sesame seeds, cracking of seeds coatings, removal of coatings by suspending in brine, roasting of decoated seeds, grinding of seeds (Tahina) Sesame sweets (Halwa Tahinya) is made by mixing equal weights of Tahina and cooked sugar.

9. THE USES OF KADELE AS PROTEIN-RICH FOOD IN INDONESIA

R. Jessu.

Kadele or *glycin max* or Soya bean, is a kind of bean from the family of Leguminaceae which is planted and grown in tropical areas. It is known to improve the fertility of the soil and therefore Kadele is planted between the two rice-planting seasons.

Kadele is rich in protein (about 35% to 40%). It has great value as a protein rich food in Indonesia where there is lack of animal protein. In Indonesia, *Kadele*, is used for making a variety of food preparations. (*Kadele* powder, *Ketjap* and *Kadele* Milk etc.)

The composition and nutritional aspects of some of these food products will be discussed.

10. ISOLATION AND CHARACTERIZATION OF ANTITHIAMINE FACTOR PRESENT IN RICE-BRAN

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Several workers demonstrated the existence of an anti-thiamine factor in rice-bran. Attempts were made to purify this principle from rice-bran in this laboratory as a result of which the anti-thiamine factor was obtained in a pure state.

The major steps in the process of purification were:

1. Extraction with chloroform water.
2. Repeated extraction with solvent.
3. Column chromatography.
4. Successive fractionation with an organic solvent.

The substance was found chromatographically to be a single substance having one R_f on silica gel G thin layer plate as demonstrated by sulphuric acid charring test. This anti-thiamine factor is a viscous substance, soluble in water, ethanol, and methanol and has no affinity toward non-polar solvents. On treatment with dilute hydrochloric acid it breaks down giving rise to a reddish brown oily layer. The original compound and the reddish brown layer both gave positive test for Emmerie and Engel's reaction indicating the presence of tocopherol-like compounds in it. The aqueous layer obtained after acid hydrolysis gave positive test for the existence of sugars. It shows absorption maximum at 270 mμ in UV region ($E_{\frac{1\%}{1\text{ cm}}} = 41.5$).

11. NUTRITIVE PROPERTIES OF DEHYDRATED GROUNDNUT PLANT MEAL IN CHICK RATIONS

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To overcome the general scarcity of grains used for human consumption, dehydrated groundnut plant meal is a newer agricultural byproduct which was tested in our laboratories for its nutritional value in poultry feeding. The green groundnut plants immediately after harvest of the nuts, were shade-dried and made into a meal. Chemical composition of this meal was as follows: 14% crude protein, 1.6% calcium and an appreciable carotene content (100 mgs/kg. of meal).

Two feeding trials of 6 weeks duration indicated that a 12% level of dehydrated groundnut plant meal in chick rations stimulated growth rate and also feed utilization. In the third experiment, in which both dehydrated groundnut plant meal and alfalfa meal were tried at different levels, it was observed that diets containing 5% groundnut plant meal resulted in a significant increase in growth rate compared to basal ration and this increase was almost equal to that containing same levels of alfalfa meal. When the levels of both meals were raised to 10% in chick rations, there was a slight and nonsignificant depression in growth rate. Liver storage of Vitamin-A was highest in chicks fed 10% groundnut leaf meal diets. This suggests that dehydrated groundnut plant meal is efficiently utilized by chicks when included at least upto 5% level in chicks rations. In all the experiments, there was a considerable economy in the cost of rations per unit weight gain compared to the basal ration containing no dehydrated leaf meal.

12. VITAMIN-C CONTENT OF MALAYSIA FRUITS

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1. GROWTH, DEVELOPMENT, FEEDING AND
WEANING PATTERNS OF INFANTS
IN SHIRAZ

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The results of a study of growth of 913 infants born in the Red Lion and Sun Maternity Hospital in Shiraz, during the first two years of life are to be reported. Weight and length curves were constructed from these measurements. A comparison with similar measurements published for infants in Western countries showed no significant difference in the birth weight or length. However, Shiraz infants had a slower growth rate and significant differences were noted at the age of 3 months for length and at 18 months for weight. These persisted during the age periods included in this study. Findings were similar for boys and girls. The role of genetic and environmental, including nutritional factors is to be discussed. Some of the developmental milestones when compared with those described by Aldrich for American infants showed a tendency toward slightly retarded development in Shiraz infants. Observations of feeding and weaning patterns show that breast feeding is almost universal and that it is continued for long periods in this population.

2. WEANING HABITS OF INFANTS IN LOW SOCIO-ECONOMIC GROUPS OF POPULATION IN BOMBAY CITY

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The influence of socio-economic factors on weaning habits and nature of supplement introduced to children was studied in Bombay city.

The investigation was carried out in ten different centres by trained personnel using oral questionnaire methods, in a representative sample of the population. 400 children upto the age of five years, consisting of 216 boys and 184 girls were taken up for the study.

Food intake of the children was collected with the objective of studying (1) The quantity, quality and the manner of introduction of supplement, (2) Relation of mothers age and parity on supplementation.

The results show that the maximum percentage (42.8%) of children completely weaned are in the age group 12-24 months. As regards length of weaning period, majority, (36.2%) are in the age group zero to three months and 83.9% are in the age group zero to 18 months.

49% of children have breast milk for the first nine months. Reduced adequacy of breast milk with the parity of the mother has been observed.

Relation between the parity of the mother and the age at the complete weaning of the child has also been observed.

3. NUTRITION EDUCATION IN THE MATERNITY WARD

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Protein-calorie malnutrition is an endemic disease in the Commonwealth Caribbean, with a multiple aetiology. A predominant and important causative factor is the decline in breast-feeding in both urban and rural areas.

A study was undertaken in the post-natal wards of two hospitals in Jamaica. 85 women between the ages of 15 and 44 years from the lower socio-economic groups were interviewed. The results showed that owing to conflicting currents of opinions and practices in the wards, the newly delivered mothers were confused and expected to learn how to feed their infants on discharge from the hospitals, advice would then be received from relatives, chemists, nurses employed by milk firms, and clinic nurses.

Soon after delivery, complementary feeds of an unspecified mixture were given to the new-born infant, although breast-feeding was attempted by most mothers, pamphlets regarding the use of artificial feeds were distributed to the mothers by ward nurses and visiting nurses employed by commercial firms. The latter also distributed free samples of milk.

94% of the mothers interviewed had already decided they would complement breast-feeding on return home, either immediately or within the first few weeks of the child's life. Patterns of infant feeding, knowledge of sterilization of equipment, and cost of infant formulae are discussed as well as remedial steps to improve the content of nutrition education in maternity wards in an effort to promote breast-feeding as the ideal, appropriate, safe, and inexpensive infant food.

4. GROWTH STANDARDS FOR INDIAN CHILDREN

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The pattern of growth and development of children in a community provide reliable information regarding their nutritional status. So far, standards established for American children have been employed for comparison purposes. It is obviously essential to have standards for each community in order to decide the true deviation of a given group from the normal attainable by it in the light of given genetic potentialities. Data obtained with regard to growth and development of children belonging to the very well-to-do segments of the population in whom constraints imposed by inadequate food intake or frequent episodes of infection may be expected to form the basis of such standards.

In this investigation, data on growth and development have been obtained in a number of children belonging to two different income groups—normal, healthy children subsisting on adequate diets drawn from well-to-do sections of the community and children belonging to lower socio-economic group.

More than 7,000 school children belonging to the high socio-economic strata and about 2,000 children belonging to the low income groups were studied. All the anthropometric measurements of the well-to-do class of children were superior to those of children of low income groups. A health and nutrition survey revealed that while 20% of the children belonging to the low income groups had one or more deficiency signs, the children of high income group were free from any deficiency signs.

A comparison between the well-to-do children from different parts of this country and American children showed that the Indian boys and girls were as tall and as heavy as their American counter-parts of corresponding ages upto a particular age, suggesting that given the proper nutrition and environment, the growth of Indian children is as good as those of American children.

5. THE EFFECT OF DIFFERENT SOCIO-ECONOMIC
FACTORS ON SKELETAL MATURATION IN
INDIAN PRE-SCHOOL CHILDREN

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This paper concerns the longitudinal study of skeletal maturation in 210 pre-school children in relation to different socio-economic status and nutrition. The skeletal developmental status of children was assessed by studying the radiographs of the left wrists of the same children when they completed 1, 2, 3, 4 and 5 years of age (± 7 days). The nutritional status of children of different socio-economic groups was assessed as good and poor on the basis of the weight (kg), signs of vitamin deficiency, elasticity of subcutaneous tissue and tonicity of muscle. The radiographs of the children were analysed for the presence of carpal and distal radius epiphyseal ossification centres and the data are compared with the standards for American children. In both the Indian and American samples, the skeletal development was found to be more advanced in girls than in boys. The carpal ossification sequence of our series is capitate, hamate, triquetral, lunate, trapezium, trapezoid and scaphoid and this agrees with the findings of others. The difference with regard to the appearance of the carpal centres between the Indian and American children is relatively small upto 2 years and tends to widen thereafter. The skeletal maturation of our children from high socio-economic group with good nutrition almost corresponds to that of American children. The skeletal maturation of children of low socio-economic group with poor nutrition is considerably delayed as compared to American children. It appears that skeletal maturity in well-fed children of different countries of the world occurs at a similar rate. It indicates that nutritional factor plays more crucial role in skeletal maturation of children than racial factor.

6. NUTRITIONAL STATUS OF INFANTS AND
PRE-SCHOOL CHILDREN IN NORTH
EAST THAILAND

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7. A LONGITUDINAL STUDY OF GROWTH OF LOW
INCOME GROUP BENGALI HINDU CHILDREN
FROM BIRTH UPTO 18 MONTHS OF AGE

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This paper deals with the growth pattern of a homoeogenous group of children born to low income group Bengali Hindu parent, residing in a slum area of Calcutta. These children were registered at birth and were followed regularly at 14 ± 2 days interval for the first year and at 28 ± 7 day interval for the subsequent period. The growth pattern as indicated by weight, height, stem-length, cranial circumference and chest circumference has been presented. The growth of these children has been correlated with their feeding practice, maternal attitude towards health care and episodes of illness.

Two hundred and twenty five children were registered at the start of the study. At 18 months there were 156 children.

Five children remained persistently below the 25th percentile of weight. Five boys and 5 girls remained persistently above 75th percentile of weight. The rest showed considerable variation in their growth pattern. This growth variation is analysed in detail.

8. NUTRITIONAL STATUS OF A GROUP OF IRANIAN MOTHERS AND CHILDREN IN RELATION TO THEIR SOCIO-ECONOMIC BACKGROUND

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A comparative study of the birth weight of two groups of neonates indicates that at birth babies belonging to mothers of high socio-economic strata of the population were significantly heavier than those of lower socio-economic class. This could be attributed to the poor nutritional status of mothers before and during pregnancy.

From the low socio-economic group, 91 mothers who were attending Leila Welfare Clinic and live in a slum area in the south of Teheran, were studied. Information concerning family size, infant and child mortality, living conditions, literacy rates and family income in relation to food intake was collected. In order to evaluate the nutritional status of the mothers, some anthropometric measurements and biochemical determinations were also carried out.

The results of longitudinal growth study of children of the above-mentioned families revealed obvious failure to grow right from the first few months of life. This growth retardation is the result of failure in breast feeding and an early weaning to a highly contaminated diet of low nutritional value and also repeated episodes of infection aggravating the poor nutritional condition of those infants and children.

9. A STUDY OF FOOD HABITS OF URBAN
FAMILIES IN DJAKARTA

Ig Tarwotjo,
Keba Joran Baru, Indonesia.

10. COMPARATIVE DATA ON THE PHYSICAL
STATUS, DIETARY INTAKE, CLINICAL
AND BIOCHEMICAL STATUS OF THE
SCHOOL CHILDREN (7-12 YEARS) IN
THE LOWER AND UPPER CLASSES

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The aim of these investigations was to get data on the physical, nutritional and biochemical status of poor children in a selected village and compare the same with regard to norms obtained on upper class children.

Subjects from lower and upper classes were selected from rural and urban areas respectively. The parameters measured were height, weight, food intake, urinary excretion of creatinine, nitrogen, thiamine, riboflavin, N' methyl nicotinamide and vitamin C, blood hemoglobin, serum concentration of protein, albumin, carotene and vitamin C. Clinical assessment was made using the ICMR schedule,

The studies showed the unsatisfactory nutritional status of poor children as compared to the upperclass children. The gap between the lower and upper class subjects with respect to the above parameters could be narrowed if adequate nutrition is provided to the lower class subjects.

11. ASSESSMENT OF NUTRITIONAL STATUS
IN INDIAN SCHOOL CHILDREN

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Since 1965, over 5,000 school children have been studied for nutritional status in and around Delhi. The anthropometric and biochemical data demonstrate definite role of nutrition on physical and sexual growth of these children.

12. SOME METABOLIC AND DEVELOPMENTAL ASPECTS OF CARBOHYDRATE MALNUTRITION

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The clinical picture of carbohydrate malnutrition consisting of loss of weight, increased appetite, marked restlessness, polyuria etc., and occurring mainly among the high socio-economic group has been reported earlier. In the present series majority of children were under the age of one year. Because of the nonaddition of sugar to the milk or cereals and other solids in later infancy and early childhood, the carbohydrate intake on an average provided 22% of the total calories. Thus there was an increased supply of calories from proteins (mean 18%) and fats, (mean 63%). Depending upon the intake of calories from the diet, the cases could be divided into hypercaloric type (calorie intake more than 110 calories / kg.), isocaloric (intake from 90 to 109 calories / kg.) and hypocaloric (below 90 calories / kg.) per day. Treatment consisted of adding one teaspoon of sugar to 3 to 4 oz. of milk formula, and in later infancy and early childhood in the addition of supplementary foods rich in carbohydrates. With treatment, the milk intake was reduced in all children of hypercaloric type of condition. There was marked improvement in general condition, and rapid increase in weight from 1 to 1.5 kg. in the first month and 2.5 to 3 kg. in three months. With treatment the calories supplied from carbohydrate increased from 18.6 to 44.7%, that from fat dropped from 54 to 39% and of proteins from 17.8 to 15.7%. The syndrome does not occur if carbohydrate provides 32% or more of the total calories. In 3 children addition of carbohydrates in diet to provide 45 to 50% of the total calories produced effective weight gain and improvement in spite of addition of proteins and fats during treatment indicating that it is the lack of carbohydrate in the diet which is the most important cause of the condition.

13. EFFECT OF CALCIUM AND VITAMIN-D SUPPLEMENTATION ON THE GROWTH OF PRE-SCHOOL CHILDREN

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The poor growth and development of children belonging to the low socio-economic groups in our country is largely due to inadequate food intake. Apart from dietary deficiency of calories and protein, deficiency of other nutrients like minerals and vitamins may also interfere with optimal growth.

The calcium content of diets of pre-school children is well below the recommended levels. An investigation carried out at this Institute earlier to determine the effect of supplementation of calcium on the growth of pre-school children failed to show any significant improvement on the growth of these children, when additional calcium was given either alone or with protein supplements. It was considered possible that vitamin-D could have been a limiting factor in those studies. An investigation was, therefore, undertaken in a rural area near Hyderabad to assess the effect of supplementation of vitamin-D given either alone or together with calcium, on the growth of pre-school children.

A total of 165 boys and 202 girls between the ages 1-4 years belonging to the low-socio economic group were selected; they were divided into four groups; the first received 300 mg. of calcium as calcium glycerophosphate, the second received 400 IU of vitamin D₂, the third received 300 mg. of calcium and 400 I.U of vitamin D₂ daily and the fourth group served as controls. They were fed for six days in a week.

Before the supplements were started, the nutritional status of the children was assessed and their heights and weights recorded. At the end of eight months of supplementation, the heights and weights were redetermined.

No significant difference was observed either in the height or weight between the four groups of children indicating that under the existing conditions, supplements of calcium and vitamin D₂ do not promote better growth. The possible role of inadequate calorie intake in these children for the observed lack of beneficial effects is currently being investigated.

14. TRENDS IN SELECTION OF BODY-BUILDING AND PROTECTIVE FOODS

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A survey was conducted to study the trends in selection of protective foods in urban families. The foods included in the study were sources of protein (milk, eggs, meat, pulses and nuts) and sources of vitamins-A and C (leafy vegetables, carrots, tomato, papaya, orange, guava, sweet lime and amla (gooseberry)).

The total number of families included in the survey was 134. The number of family members ranged from 2 to 9; 58 percent had 2 to 4 members; 39 percent had 5 to 6 members.

Thirteen percent of the families had an income less than Rs. 90 per month per head; 33 per cent had between Rs. 100 and Rs 160,- per month; 22 percent between Rs. 161 and Rs. 240; 21 percent between Rs. 241 and Rs. 400.

Only 18 families included meat, eggs and fish in their diet and 13 families included only eggs in their diet. The remaining 103 families were lacto vegetarians.

All the families included milk and pulses in their diet. The average consumption of pulses per person per day varied from 40 to 44 g. in the various income groups. The consumption of milk increased with increase in income. Eighty-five families included on an average 5 to 10 g. of nuts per day in their diet.

126 families included green and yellow vegetables, the average frequency being 5 times a week. 124 families included vitamin-C-rich fruits. The frequency of consumption increased with income from 4 to 8 times a week.

15. IODISATION PROGRAMME IN THAILAND

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It was observed by survey and laboratory analyses that the prevalence of goitre in the Northern part of Thailand was indeed high, the percentage range approximately 30 to 90. The principal cause of disease is low iodine intake due to low environmental iodine supply. Therefore, iodisation programme was considered with the iodation of salt as a method to implement the programme. In 1962 the iodation plant with a capacity of 4,000 tons per year was set up at Prae, one of the Northern Provinces, as a pilot project, and two years later, the big plant with a capacity of 14,000 tons per year, was established in Bangkok. The iodated salt was distributed to all the areas, especially the North. In 1969, a follow up resurvey in school children of same schools as the preceding surveys was made. It showed a dramatic reduction of goitre rate in iodated areas. It is expected, if iodisation programme is continued in proper way, goitre will not be a public health problem any more.

16. EFFECT OF BALANCED DIETS AND ZINC
SUPPLEMENTATION ON HYPOGONADAL
DWARFS

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A syndrome of impaired growth and hypogonadism often accompanied by hepatomegaly and anaemia and associated with lowered concentrations of zinc in plasma has an incidence of about 3.5% among 18 to 20 year old males in the rural population of Iran (Ronaghy, 1970). It has been attributed to deficiency of zinc although evidence for this has been inconclusive. During the past two years, therapeutic trials with zinc have been made on dwarfs 18-20 years old, affected with the syndrome as volunteer subjects. By randomized selection they were given either a well-balanced diet with a placebo (Group I), the same diet plus 120 mg. of Zinc sulphate each day (Group II) or the Group I treatment for 6 months followed by Group II treatment. Although nearly all showed some increase in height during the period of study, the response was significantly greater in those receiving zinc with one exception. This subject had no teeth and in addition, showed intestinal malabsorption. Zinc treated subjects also showed an increase in gonadal function and development of secondary sexual characteristics to a greater extent than the controls.

1. EFFECT OF FASTING AND PROTEIN STARVATION
AND SUBSEQUENT REALIMENTATION ON THE
LIPID COMPONENTS OF BRAIN

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A study was undertaken to determine the effect of fasting and of protein starvation followed by refeeding on the lipid composition of brain in rat. Groups of albino rats 8-9 weeks old and 135 to 145 gm. body weight, were fasted for one day, four days or protein starved for one week. The starved rats were then refed the complete diet for four days and one week to study the regeneration of the lipid constituents in the brain.

No change in the lipid composition of the brain was noted after one day fasting except with the free cholesterol content which was significantly decreased. At four days of fasting or one week of protein deprivation, the concentration of total phosphatidyl choline, phosphatidyl serine, cardiolipin, sphingomyelin and lysolecithin were significantly higher than in the unstarved animals. Esterified cholesterol increased with four days of fasting, but decreased significantly with one week of protein starvation. Phosphatidyl inositol and triglycerides remained unchanged during starvation as well as in protein fasting.

When the fasted rats were refed complete diet, it was found that rats were able to restore normal brain weight but the recovery of the body weight was partial; and the different components of the brain lipids were restored to the levels found in normal animals.

2. CELLULAR GROWTH AND DEVELOPMENT IN DIFFERENT REGIONS OF HUMAN BRAIN.

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Information on the chemical composition of human brain is scanty, particularly regarding the changes during intrauterine growth of the foetus. The pattern of biochemical changes during the development of human brain was, therefore investigated. Brains from foetuses of different gestational ages ranging from 13 to 42 weeks were obtained and each brain was separated into the three anatomically distinct regions viz., cerebrum, cerebellum and medulla oblongata. The concentration of deoxyribonucleic acid (DNA), Ribonucleic acid (RNA), protein and lipids in each region was determined.

Nucleic acids, protein and lipids were found to increase linearly with advancement in gestation period till about 32 weeks. There was no significant net increase in any of these substances between 32 and 36 weeks. However, from 36 weeks onwards there was a sharp increase in all the constituents till birth suggesting that between 32 to 36 weeks there is a lag in the growth followed by a growth spurt between 36 and 40 weeks. The decrease in the rate of growth between 32 and 36 weeks was observed consistently in all three regions of the brain. Comparison of the present data with that reported by Western workers revealed that the 'lag period' followed by growth 'spurt' discussed above is perhaps a characteristic feature of human brain development. The pattern of development observed in the present studies, however, also showed that the occurrence of the lag period and therefore the growth 'spurt' was delayed by four to five weeks as compared to the Western data.

3. EFFECT OF DIETARY CELLULOSE SUPPLEMENTS ON THE BODY COMPOSITION AND CHOLESTEROL METABOLISM OF ALBINO RATS

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The effect of inclusion of microcrystalline cellulose (>300 mesh) in a 26% casein diet on the body composition and cholesterol metabolism of albino rats was studied. Inclusion of cellulose to the extent of 5 to 20% resulted in a gradual decrease of productive energy of the diet. Energy consumption rates progressively declined as dietary energy level was reduced and were reflected in corresponding changes in the fat content of the carcass. Increased plasma and liver cholesterol induced by cholesterol feeding in the rat could be largely counteracted by the concurrent feeding of cellulose at 20% level in the diet. Sulfaguanidine fed at the 1% level failed to modify the effect of cellulose administration. The increased excretion of bile acids in the feces of rats on the 20% cellulose diet could be responsible for the cholesterol lowering effect of cellulose.

4. EFFECT OF LEUCINE ON SOME ENZYMES OF TRYPTOPHAN METABOLISM

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Dietary excess of leucine has been implicated in the pathogenesis of pellagra. Its precise biochemical role in the causation of pellagra has not been fully elucidated. Increased excretion of quinolinic acid in urine and impairment in the NAD synthesising capacity of erythrocytes have been reported to be two of the striking changes induced by excess leucine. It is, however, not clear whether this increased quinolinic acid excretion is due to an increased breakdown of tryptophan or a block in the utilisation of quinolinic acid for NAD synthesis.

To investigate this problem some of the enzymes of tryptophan metabolism were studied in the liver and the kidney. The enzymes studied were: Tryptophan pyrrolase, 3 'OH' Anthranilic Acid Oxidase, quinolinate phosphoribosyl transferase (QPRT) and Picolinic carboxylase.

These studies were conducted on 28 days old male albino rats. Animals fed a marginal protein diet (9%) served as the control group. Experimental animals received this diet with leucine supplemented at different levels. At the end of four weeks of feeding the enzyme activities were estimated in the liver. The results of the study showed that the tryptophan pyrrolase activity had increased, the quinolinate phosphoribosyl transferase activity had decreased, there being no change in 3 'OH' anthranilic acid oxidase and picolinic carboxylase activities in liver as a result of leucine feeding. Picolinic carboxylase activity in the kidney, however, had increased considerably.

5. *IN VITRO* STUDIES ON AMINO ACID TRANSPORT
FROM SMALL INTESTINES IN
PROTEIN DEFICIENCY

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An *in vitro* study of transport of amino acids in small intestines was undertaken in young albino rats, fed on protein deficient diet (4% protein). The results were compared with that of the control animals, fed on 18% protein diet. The everted sac technique was employed for the purpose with slight modifications. The amino acids studied were L-proline and L-lysine. First, both the amino acids L-proline and L-lysine were studied singly for their transport across the intestine at low concentrations. The inhibition of proline transport by other amino acid (like glycine) was studied in another group of animals. The effect of the presence of various amino acids, in concentration ratios, similar to that of egg-albumin, was studied on the transport of L-proline and L-lysine.

6. VITAMIN-E BINDING TO CELLULAR PROTEINS

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Association of vitamin E (α -tocopherol) with low density serum lipoproteins has been shown by several workers. The present study has been undertaken to examine possible binding of α -tocopherol with cellular proteins in relation to its functional significance.

Intracellular distribution pattern of α -tocopherol in rat liver indicates that it is largely present in mitochondria, $105,000 \times g$ supernatant (cell sap) and microsomes. This distribution pattern remains unchanged after administration of large doses of 3H - α -tocopherol. Most of the recoverable radioactivity in the cell sap is associated with two lipo-protein fractions on Sephadex gel filtration. The elution pattern of one of these resembles closely to the very low density lipoproteins (VLDL) carrying most of the orally fed α -tocopherol in the serum.

A time study of the appearance of 3H - α -tocopherol activity in serum and in liver cell particulates following oral administration indicates parallel increases in specific activity which reaches a maximum in 4 hours. The results suggest that VLDL acts as carrier of the orally fed vitamin.

These results are discussed in relation to protein status of the animal.

7. BIOCHEMICAL CHANGES IN THE DEVELOPING RUMEN OF BUFFALOES

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Thirty-two milk-fed Murrah buffalo-calves of three weeks of age were randomly allotted to four dietary groups-milk (CoRo), concentrate berseem hay 1:1 (C1R1), 1:3 (C1R3) and berseem hay alone (CoR4). Milk was gradually reduced and completely stopped after the sixth week of age in the groups on solid feeds. Two calves from each group were slaughtered at 6, 9, 12 and 15 weeks of age. In addition, four buffalo-calves at 21 days of age were slaughtered for comparison.

Concentration of total volatile fatty acids (VFA) in the rumen liquor was maximum at nine weeks of age. The proportions of acetic acid increased with hay in the diet as well as with age. In the milk-fed, ruminal VFA had a narrower acetic/propionic ratio than in other groups. At nine weeks of age, the level of non-protein nitrogen in rumen liquor increased, while that of protein nitrogen fell, indicating the onset of typical microbial activity.

It is concluded that the rumen of buffalo calves given solid feeds from the seventh week of age becomes functionally developed by nine weeks of age, whereas it remains under-developed in buffalo-calves fed milk upto 15 weeks of age.

8. CYTOGENETIC STUDIES ON ENDEMIC
CRETINISM IN THE GOITRE
VILLAGES

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9. ROLE OF VITAMIN-C IN PIGMENTATION
OF TOAD (*BUFO MELANOSTICTUS*)

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Effects of vitamin-C have been studied on melanin formation in liver, skin and vocal sac of normal and hypophysectomized toad. After hypophysectomy melanin content was diminished in the skin and vocal sac but increased in liver. Vitamin-C administration in normal and operated animals on the second day after hypophysectomy, increased the melanin pigments in liver, skin and vocal sac. It is concluded that vitamin-C regulates melanin formation independent of pituitary gland in toads.

10. EFFECT OF *LATHYRUS SATIVUS* FEEDING ON BIOCHEMICAL CHANGES IN GUINEA PIGS

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Lathyrism, a disease that not only cripples the victims but the entire economy in the geographical region, has been a threat since centuries in Central and Northern India. The disease is caused by the excessive consumption of the pulse *Lathyrus sativus*, and is a vital nutritional problem in India which deserves an immediate attention. The present study has been undertaken in order to understand and interpret the biochemical and physiological alterations undergone by the tissues, especially liver, as a result of excessive consumption of *Lathyrus Sativus*.

Healthy guinea pigs weighing 203-250 g. were selected and divided into two identical groups. One group was fed on control diet and the other on experimental diet for 6 weeks. The experimental diet was prepared by replacing Bengal gram of the control diet by 50% *Lathyrus Sativus*. The animals kept on the *Lathyrus Sativus* consumed less food and showed retarded growth as compared to controls. There was an inflammation of hind and forepaws after the 3rd week but no obvious paralysis, although they were reluctant to move. The blood glucose was observed to be appreciably higher whereas the hepatic glycogen and protein were significantly lower than the controls. These observations indicate that excessive consumption of *Lathyrus Sativus*, probably, disturbs the carbohydrate and protein metabolism. The total lipid and phospho-lipid contents of liver in the two groups did not show any significant differences although the animals fed on *Lathyrus Sativus*, showed a tendency towards a decrease.

11. PURIFICATION AND PROPERTIES OF AN
AMYLASE INHIBITOR FROM COLOCASIA
(*Colocasia Esculenta*) TUBERS

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A method of isolation and purification of an amylase inhibitor from colocasia (*Colacasia esculenta*) tubers is described. The purified amylase inhibitor is a white, amorphous, hygroscopic powder containing 15.6% nitrogen. It is deficient in methionine and tryptophan. The amylase inhibitor gives a typical protein spectrum with a maximum at 280 and minimum at 252 mu. Electrophoretically it is homogeneous over a wide range of pH.

The amylase inhibitor is stable to boiling temperatures and specifically inhibits salivary amylase. The nature of inhibition is non-competitive. The activity of the inhibitor is destroyed by proteolytic enzymes, ficin and pepsin.

12. DIETARY NITROGEN AND ITS METABOLITES IN BUFFALO RUMEN

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In four adult male buffaloes with permanent rumen fistulae, the effects of four sources of dietary nitrogen (groundnut cake, cottonseed cake, guar meal and urea) were studied in a 4×4 Latin-square-cum-switch over design. Each animal, on each diet received iso-nitrogenous and probably, iso-caloric feeds.

After the animal was adapted to each diet for a month, samples of rumen 'liquor' (Fluid) were collected at 0, 2, 4, 6 & 8 hours post-feeding and analysed for total N, protein N, ammonia N, NPN and residual N.

In the rumen liquor, cotton seed cake produced the maximum levels of protein N, while guar meal resulted in the lowest levels. Urea liberated the highest levels of ammonia followed by groundnut cake; guar meal gave rise to prolonged uniform levels of it.

These results will be discussed in relation to the relative values of these proteinaious feeds.

13. STATUS OF SUCCINIC DEHYDROGENASE IN
IRON DEFICIENCY

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Studies on 57 subjects with iron deficiency anaemia showed a depressed activity of the enzyme succinic dehydrogenase in blood of nine. This defect was also present in the bone marrow and skin in a significant number of subjects. That the depression in the activity of the enzyme was due to lack of iron was proved by *in vitro* activation of the enzyme by addition of elemental iron. Re-evaluation of the enzyme activity following oral iron therapy showed improvement in the status of enzyme activity.

1. NUTRITIONAL STUDIES ON SINGLE CELL
PROTEIN OBTAINED FROM
PETROLEUM HYDROCARBONS

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Single cell protein (SCP) obtained by culturing yeast on gas oil has been studied for nutritional quality. Besides the type of yeast used, it has been found that the processing conditions have important effects on the nutritional quality of protein. Analysis of the product shows that it contains 50-60 per cent crude protein (Nx 6.25) and 5-7 per cent nucleic acid. Substitution of the control diet at 10 per cent level of protein by SCP maintained the growth of rates comparable to those of control animals. Toxic and Pathological effects of feeding SPC to rats have also been studied.

2. NUTRITIVE VALUE OF FISH FLOUR FROM SHARK MEAT

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Among the high protein foods of marine origin, Shark Meat, deserves greater emphasis from Nutritionists as it is not commonly utilised as a popular human food except in Australia. Presence of urea upto 2% in elasmobranch muscle affects both the flavour and the keeping quality of the processed products using traditional methods. The present authors have investigated the possibility of its conversion into fish flour, advocated in recent years as a solution to problems of malnutrition in Asia. It is of interest to note that tropical waters abound in these ill-utilised fish, known for their high protein content. Without taking recourse to urease treatment, the authors have developed an integrated process for obtaining urea free shark flour based on cooking, soaking in dilute acetic acid and alcohol extraction. The final product pale yellow in colour and bland in taste showed a protein content of 99% and was found to be acceptable at 15% level in cereal preparations.

In view of the conflicting reports in existing literature essential amino acid composition has been studied in greater detail employing chemical and microbiological methods. Lysine content is 12.88% (microbiological assay), available lysine being 9.77%. Protein efficiency ratio (P. E. R) of shark protein was observed to be 2.96 ± 0.24 as compared to skim milk protein (3.00).

It is estimated that the cost of the final product may not exceed Rs. 3.50 per kg. not taking into consideration the scope for by-product utilisation for which shark is ideally suited. Annual landings of sharks and rays in India is of the order of 40,000 tons.

3. NUTRITIONAL STUDIES ON DEHULLED SESAME PROTEIN CONCENTRATE

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Presence of hull in Sesame (*Sesamum indicum*, L) contributes to colour, bitterness, high oxalate and fibre content of the meal and thereby limits its use as a protein supplement. This drawback was overcome by wet dehulling of the seed using lye treatment. The edible flour obtained from the dehulled seed has over 50 per cent protein content and its nutritive quality is superior to that of the unde-hulled sesame cake. Supplementation of the flour with lysine, the only limiting amino acid in sesame protein, significantly improves the nutritive value of the protein concentrate comparable to that of skim milk powder.

The high level of sulphur amino acids, particularly methionine present in sesame suggests its use as a supplement to diets deficient in these amino acids. Wheat and rice based typical Indian diets are reported to be most limiting in sulphur amino acids, when compared with the amino acid pattern of egg. A study on the effect of supplementation of wheat diet with optimal level of methionine or sesame flour with and without addition of lysine, minerals and vitamins was carried out in weanling rats. While addition of methionine or sesame flour did not improve weight gains and feed efficiency of rats, lysine supplemented sesame flour gave a better growth response. In all cases fortification with minerals and vitamins resulted in significant improvement in the overall nutritive value of the diets.

Since sesame flour is one of the few rich sources of methionine among plant proteins and shows marked improvement in its protein quality on lysine supplementation, it can be used with advantage in the preparation of processed protein supplements for human consumption. Incorporation of dehulled sesame flour in composite protein foods based on legumes has been found to improve their protein quality.

4. NUTRITIONAL EVALUATION OF LEAF PROTEINS USING THE ACTIVITY OF XANTHINE OXIDASE AS AN INDEX

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The nutritional evaluation of leaf proteins prepared from raw materials and processed differently has been carried out with respect to their capacity to promote growth and replenish the cellular components of the protein depleted livers as reflected in the activity of xanthine oxidase.

The study was carried out in three experiments:

- a) to study the effect of complete starvation and refeeding casein and berseem leaf protein concentration (LPC).
- b) to study the effect of leaf proteins under different drying conditions.
- c) to study the effect of different leaf proteins in regeneration of protein depleted rats.

Rats when starved for 3 and 6 days, suffered a great loss in body and liver weights and in liver total nitrogen and xanthine oxidase activity. When the 6 days starved animals were re-fed casein and berseem LPC the response in the above parameters was significantly lower in case of berseem LPC than casein, thus indicating that berseem LPC is inferior to casein. In a second experiment the diets prepared from casein and cowpeas LPC as wet cake and those dried at 60°C and 80°C were fed to weanling rats for 4 weeks. Casein was found to be better than Cowpeas LPC diets and the cowpeas LPC as wet cake were superior to that dried at 60°C and 80°C with respect to liver weight, liver total nitrogen and xanthine oxidase activity. The body weight gains with casein diets were considerably higher than those with cowpeas LPC diets. In another experiment, the rats were protein starved for 3 days. They lost in body weight, liver weight, liver total nitrogen and xanthine oxidase activity. Regeneration with casein displayed maximum values in terms of body and liver weight, liver total nitrogen and xanthine oxidase activity than with LPC from berseem, cowpeas and cauliflower. However, cauliflower LPC was found to be better than the other LPC preparations.

5. INCLUSION OF WILD LEGUMINOUS SEED PROTEINS IN ANIMAL NUTRITION

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High protein content of several wild leguminous seeds suggested their possible inclusion in animal nutrition. However, their unpalatability, bad odour and toxicity in some cases, despite their nutritional adequacy, disallowed feeding of the entire seeds. Therefore their soluble proteins were extracted, fractionated and isolated in more or less pure form at appropriate pH. Amino acid analysis of the protein isolates revealed them to possess fairly balanced amino acid pattern although in good many cases, methionine and tryptophan appeared to be the limiting factors as substantiated by analysis as well as animal experiments. Supplementation of the protein isolates with the limiting factors (methionine and tryptophan) wherever necessary, restored normal growth in experimental animals and also proved to maintain a positive nitrogen balance in them.

When adequately balanced with the essential amino acids, the wild seed protein isolates do not appear to induce any deleterious physiological after-effects on the experimental animals as evinced by liver protein and several enzyme assays. Thus the results obtained tempt one much to recommend their suitability for inclusion in animal nutrition and perhaps in human nutrition as well. However, long-time decisive feeding trials are necessary before any final conclusions are drawn.

6. A SPECIFIC ENZYMATIC PROCEDURE FOR THE
DETERMINATION OF β -OXALYL-L- α - β DIAMINO
PROPIONIC ACID PRESENT IN
LATHYRUS SATIVUS

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β -oxalyl-L- α , β diaminopropionic acid (ODAPRO) is one of the main neurotoxic components present in the seeds of *Lathyrus sativus* (Khesari dal). Khesari dal is used as an adulterant of *Cicer arietinum* (Bengal gram), *Cajanus cajan* (Red gram) and other pulses in view of its comparatively low cost. A paper electrophoretic and chromatographic procedure for determination and an anthocyanin test for detection of adulteration with khesari dal have been reported. These methods lack the specificity and sensitivity of an enzymatic procedure.

The present method involves extraction of ODAPRO from the test sample, separation from neutral, basic and mildly acidic amino acids on a cation exchange column and acid hydrolysis. Hydrolysis of ODAPRO to oxalate and L- α , β diaminopropionic acid (DAPRO) is nearly quantitative. The DAPRO formed is converted to pyruvate by a specific ammonia lyase purified from extracts of a pseudomonad. Pyruvate is determined as its 2:4 dinitrophenyl hydrazone by standard procedures or with the NAD dependent lactate dehydrogenase.

Data on the ODAPRO content of several samples of khesari dal as determined by chromatographic and enzymatic procedures will be presented.

7. DRIED BEET PULP AS A GRAIN REPLACEMENT FOR DAIRY COWS AND SHEEP

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Six experiments were conducted to study and improve the nutritional value of dried beet pulp for its efficient and optimum utilization in the rations of ruminants. In the first experiment, three metabolism trials were conducted with wether lambs to study the nutrient digestibility and energy utilization of rations containing four different levels (0-60%) of beet pulp as a replacement for corn in the control ration. No significant differences were observed in the digestibilities of dry matter, energy and crude protein of rations containing even 60% beet pulp or comparable level of corn. Crude fiber digestibility increased at each increase in the level of pulp. The metabolizable energy of the rations did not change and averaged at about 71% of gross energy. A lactation trial involving eight cows in the second experiment showed no significant difference in fat corrected milk production when a control ration containing 57% barley was compared with a 55% beet pulp ration. The result of the third experiment indicated that when four per cent fat was added to a fat deficient ration containing 50% beet pulp, milk yield increased significantly by 7.5%. In three successive experiments the effects of feeding high concentrate rations containing four levels of corn or beet pulp on yield and composition of milk, body weight gain, energy utilization and rumen fermentation characteristics of cattle and sheep were studied. No significant differences in yield and composition of milk, and body weight gain was observed even when 73% of the corn in the control concentrate ration was replaced by beet pulp. The metabolizable energy of the rations averaged 2790 kcal/kg and did not differ significantly. An increased production of rumen VFA and a less frothy rumen ingesta were observed when beet pulp replaced corn in the high concentrate dairy ration.

8. THE ABSORPTION OF IRON FROM RICE AND WHEAT

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Iron deficiency anaemia is widely prevalent in India in spite of seemingly adequate amounts of dietary iron. Most of the iron, however, is derived from cereals—rice or wheat, which is the staple. Chemical balance studies have shown that the availability of iron from these foods is relatively low. The validity of chemical balance data has, however, in recent times, been questioned. Absorption of iron from rice and wheat was, therefore, determined in 23 normal healthy human volunteers by the standard meal technique, using either labelled ferrous sulphate or a standard meal spiked with ^{59}Fe . A dose of 5 mg. of iron was given on an empty stomach. The radio-activity excreted in feces over the next 6—8 days was measured in a NaI scintillation probe of a medical spectrometer with a fixed geometry. The average iron absorption was 33% from ferrous sulphate, 8.6% from rice and 12.6% from wheat meals. These results are similar to those found earlier using chemical balance studies. It is proposed to further confirm these data using the double isotope technique.

9. THE AVAILABILITY OF IRON FROM GREEN
LEAFY VEGETABLES AS COMPARED TO
IRON SALTS FOR SCHOOL CHILDREN

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Anaemia is one of the major public health problems in India. Surveys conducted by the Nutrition Research Laboratories (1968) have revealed that approximately 50 per cent of the children in India have haemoglobin levels less than 10 g. per cent.

Green leafy vegetables furnish liberal quantities of iron in the vegetarian diets. They have the additional advantage of being rich in carotene, folic acid and vitamin-C. Nirmala *et al.* (1968) found a significant increase in the haemoglobin and PCV value of a group of adolescent girls fed amaranth when compared to that of a group fed iron tonic. Similar findings were reported by Devadas and Prema (1969) on elementary school children.

The present study compares the availability of iron from a green leafy vegetable, namely, *Amaranthus flavus* and iron supplements in the form of a salt 'Fersolate' and a tonic 'Coll-iron' given as supplements in a school lunch, over a period of eight months.

10. BIOLOGICAL EVALUATION OF THE PROTEINS
OF RAMDANA (*AMARANTHUS CAUDATUS*)

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Studies were carried out in male weanling albino rats to evaluate the nutritive value of a protein isolate from Ramdana, the seed of *Amaranthus caudatus*. On the basis of a protein efficiency ratio of 2.5 for casein, the protein efficiency ratio of the Ramdana protein isolate was 1.8. The animals receiving the control casein diet showed superior weight gains and protein efficiency ratios. However, the vegetable protein isolate was found capable of maintaining normal hemoglobin levels, liver protein content and xanthine oxidase activity in rats.

The biological value as determined by nitrogen balance trials in rats was found to be 70% for casein and 65% for the Ramdana protein isolate.

Amino acid supplementation studies indicated that lysine was the limiting amino acid in Ramdana protein. Significant improvement in protein quality was obtained when the protein isolate was supplemented with lysine. Further study is needed to delineate the optimum level of lysine supplementation.

The protein isolate incorporated at 18% level in the diet supplied adequate quantities of methionine for the growing rat. Furthermore, *in vitro* digestibility studies showed that it did not contain any tryptic inhibitor. It was readily accepted by the experimental animals and was free of adverse physiological effects.

11. PRESENCE OF TRYPSIN-INHIBITOR IN *LATHYRUS SATIVUS* SEEDS

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The presence of neurotoxic compounds in the seeds of *Lathyrus sativus* has been reported earlier from these Laboratories. Many legumes are known to contain trypsin inhibitors and it was considered possible that *Lathyrus sativus* may also have an anti-tryptic factor which may not only affect its nutritional value, but also have an association with the neurotoxic properties of the legume.

Pulverised *Lathyrus sativus* seeds were extracted with phosphate buffer (pH 7.5) and with distilled water. Both extracts had anti-proteolytic activity when tested against trypsin as the enzyme. The trypsin inhibitor was isolated and purified from *Lathyrus sativus* seeds, and found to be a single protein compound with 12.1% protein, on dry weight basis. The purified inhibitor was thermolabile and four times more susceptible to heat treatment than the crude preparations.

12. FURTHER STUDIES ON FISH PROTEIN CONCENTRATES TO OVERCOME PROTEIN MALNUTRITION

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With the enormous increase in population every year we will be unable to protect the human race from severe protein depletion. We will be forced to resort to the inexhaustable and nearly unutilized reserves of the oceans. The seasonal catches of certain cheap and abundant varieties of fish could be conserved for better utilization in the form of fish protein concentrates (FPC).

A number of FPC samples utilizing these surplus fish such as silver bellies, have been analysed for their proximate composition and for their methionine and available lysine content. FPC is a rich source of protein containing more than 80% protein and methionine and available lysine content is in the range of 2.8-3.5 and 9-10 g/100 g. protein respectively. Many of the common diets being deficient in protein and methionine and available lysine could be nutritionally improved by supplementing them with FPC.

To process huge quantities of available fish it is necessary to preserve them till they are taken out for FPC manufacture. In this connection studies have been concluded using oil sardines of low, medium and high fat content. The fish with high fat content could be left with ethanol for 3-4 days whereas fish with low fat content could be taken out of ethanol after a storage period of about a week. These studies are based on FFA content of fish and the changes in colour in storage of fish under ethanol.

FPC has been successfully incorporated at a high level of about 25% in the form of wafers. This will not present any difficulty in popularising FPC as the product is attractive in appearance and other aspects.

There is also a great possibility of preparing FPC type C by modifying the characteristic flavour of fish by use of pure cultures such as *Aspergillus oryzae*, *A. flavus* along with suitable nutrients.

13. POULTRY LITTER AS A SOURCE OF PROTEIN AND ENERGY FOR RUMINANTS

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Poultry litter, a waste product of the poultry industry comprising mainly chicken excreta and the bedding material used in the poultry house is presently used primarily as fertilizer. The annual production of litter in Lebanon has been estimated to be between 100 and 135 thousand metric tons.

Three experiments were conducted to study the protein and energy value of poultry litter for ruminants. The local wood shaving poultry litter analyzed 28% crude protein and 15% crude fiber, dry matter basis. Three digestion trials were conducted in the first experiment with eight wether lambs fed rations containing 0, 25, 50 and 75% unprocessed litter. No significant differences were observed in the digestibilities of different litter nutrients as the level of litter increased in the rations with the exception of crude fiber which was higher at the 25% litter level. The DP and TDN values of the litter when used even at the 75% level in the ration were 21.4% and 53.2% respectively. In the second experiment, equicaloric rations containing 0, 25 and 50% poultry litter were fed *ad-libitum* to three groups of Holstein bull calves during a 90-day fattening trial. Even though daily feed intake and average daily gain decreased at each increase in the proportion of poultry litter in the rations, the daily gain of 1.5 lb. in the group fed 50% litter ration was higher than the gain of stock raised locally. The result of carcass grading and taste-test indicated a significant preference of 25% litter group over control. An effort was made to increase the feed intake of the litter ration in the next experiment, by incorporating 30% screened poultry litter in a practical fattening ration containing ten per cent molasses. No significant differences were observed in the average daily gain and feed intake between the control and litter fed groups.

14. STUDIES ON THE DISTRIBUTION OF
ANTI-THIAMINE FACTOR IN
DIFFERENT FOODSTUFFS

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Several workers observed that some foodstuffs like rice (rice bran), fern, blue berries, mustard seed (*Brassica juncea*) etc. contained certain principles which inactivated thiamine. The present paper deals with the studies on the distribution of this anti-thiamine activity in different foodstuffs. These studies confirm the observations of the previous workers in some of the foodstuffs. Besides other foodstuffs commonly used by the Indian people and not tested before for the anti-thiamine activity has been analysed for the existence of anti-thiamine activity. Further preliminary studies towards the purification of the anti-thiamine factor present in the mustard seed (*Brassica juncea*) has also been undertaken by using different techniques; as a result, final material thus obtained is several times more purified in comparison with the starting material.

15. STUDIES ON THE EFFECT OF PROCESSING ON THIAMINE, RIBOFLAVIN AND NIACIN CONTENTS OF PRECOOKED DEHYDRATED PULSES

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Studies are reported on the effects of processing on thiamine, riboflavin and niacin contents of various pulses e.g., red gram (*Cajanus indicus*), black gram (*Phaseolus mungo*), Bengal gram (*Cicer arietinum*) and green gram (*Phaseolus radiatus*), which are generally supplied in a precooked dehydrated form. These dals reconstitute easily under all operational conditions including high altitude.

Expressed on dry weight basis, percentage loss of thiamine during processing including cooking at 15 lbs. for 10-30 mts. and subsequent dehydration was of the order of (11.1) for red gram, (13.8) for Bengal gram, (34.3) for black gram and (24.3) for green gram. The percentage loss of the same vitamin on reconstitution in boiling water worked out to be (11.8) for red gram, (16.0) for Bengal gram, (17.4) for black gram, but no appreciable loss was noticed for green gram dal. Similarly, processing loss of riboflavin was of the order of (20.8) for red gram, (12.0) for Bengal gram, (22.7) for black gram and (21.0) for green gram. Further losses of riboflavin on reconstitution of the precooked dehydrated pulses worked out to be (1.7) for red gram, (3.6) for Bengal gram, (2.3) for black gram and (9.9) for green gram. The percentage losses of niacin in precooking and dehydration worked out to be (12.3) for red gram, (20.1) for Bengal gram, (11.1) for black gram and (13.9) for green gram. The observed loss on reconstitution worked out to be (2.4) for red gram, (3.7) for Bengal gram, (7.9) for black gram and (4.7) for green gram. The data suggest that in the processing of pulses involving cooking at 15 lbs. for 10-30 mts. as also dehydration of cooked dals in a crossflow air drier at about 70°C for periods varying from 2-2½ hrs. for green gram to 4½-5 hrs. for black gram there is appreciable loss of thiamine, riboflavin and niacin. When reconstituted and used, these pulses, would give approximately about 70% of the vitamin originally present except for thiamine in black gram, which will be available to the extent of 50% only.

16. EFFECT OF BAKING AND DEEP FAT FRYING WITH SUGAR AND JAGGERY ON THE AVAILABLE LYSINE OF WHEAT

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Total and available lysine content was estimated in raw wheat flour and three kinds of biscuits and *pooris* (Plain, with sugar, with jaggery). Young weanling rats were fed with the above seven diets at 10% protein level. Weight gain and feed consumed were recorded. After six weeks feeding the diets were supplemented with lysine to bring the available lysine content to that of raw wheat flour and continued the experiment for two weeks.

Total and available lysine content decreased both in baking and deep fat frying processes even without addition of sugar or Jaggery. Addition of sugar did not cause any additional destruction of available lysine but the addition of jaggery resulted in the maximum loss of available lysine. Attempts were made to correlate the available lysine content of the diet with the protein quality by biological experiments. Protein efficiency ratios of all the *poori* diets were found to be lower than the biscuit diets. Addition of jaggery both in biscuits and *pooris* decreased the protein quality to a greater extent than the addition of sugar. From the observation that even after bringing the available lysine content of all the diets to the same level by supplementing with lysine, the rats on *poori* diets gained less weight than those on biscuit diets it is suggested that in deep fat frying some other essential amino acid in addition to lysine might have been destroyed.

1. COMPOSITION OF THE BRAIN IN PROTEIN CALORIE UNDERNUTRITION IN CHILDREN

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It has been generally thought that certain organs occupy a position of privilege in the economy of the body. Thus, in response to chronic protein calorie undernutrition in children, brain was thought to be spared in preference to organs like the liver which undergoes profound changes in composition. The present investigations report observations on the composition of three organs, the brain, liver and spleen in children aged 1-2 years, dying of kwashiorkor, marasmus and nephrotic syndrome. Water, lipids, protein, DNA, RNA, total mucopolysaccharides and hyaluronic acid and chondroitin sulfates were estimated in aliquots of the respective organs, which were weighed and homogenized without the addition of water. Results show that the water, protein and lipid contents of the brain were similar in the three diseases; but the RNA contents in kwashiorkor was markedly below those in marasmus which were lower than those in nephrotic syndrome. The DNA contents of the brain in marasmus and nephrotic syndrome were the same and higher than those in kwashiorkor; but considering the matched brain weights there was a reduction in the total DNA contents in the brain in marasmus. The total mucopolysaccharide contents of the brain was higher in kwashiorkor than in nephrotic syndrome but the relative fractions of hyaluronate vis a vis the chondroitin sulfates were the same. These results along with the compositions of the liver and spleen indicate that in protein calorie undernutrition in children there is a profound change in composition of the brain and the brain is not spared in the response to the undernutrition.

2. CERULOPLASMIN LEVELS IN PRE-SCHOOL CHILDREN

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Protein-calorie malnutrition (PCM) is one of the major public health problems in many developing countries. While, it is easy to identify subjects in advanced states of PCM, there is as yet no satisfactory index either biochemical or anthropometric for detecting children in the early states. There is, therefore an urgent need to identify a parameter which is simple, independent of age and applicable under field situations.

Serum ceruloplasmin—a copper containing protein of the plasma, has been shown to be markedly low in children with kwashiorkor and this level seems to fall comparatively earlier than serum albumin. Also, serum ceruloplasmin levels have been shown to be constant beyond one year of age. A study was, therefore, undertaken to determine if serum ceruloplasmin levels could be used as a biochemical index to detect mild and early cases of PCM.

More than 150 pre-school children belonging to the low-middle socio-economic groups and children belonging to the upper socio-economic group were studied. Anthropometric data like height, weight, arm length and arm circumference were recorded. Total protein and ceruloplasmin levels were estimated in a finger prick sample of blood ($5\mu\text{l}$ plasma), using a micro-method. A clinical examination was also done and the major ailments were noted for each child.

The results of the study showed that the levels of ceruloplasmin in the under-nourished children were not in any way different, indicating that it can not be used as a parameter to detect early cases of PCM.

3. ANTIDIURETIC HORMONE IN PLASMA AND URINE OF MALNOURISHED CHILDREN

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Though oedema is a central feature of advanced states of protein calorie malnutrition (PCM), the exact mechanism of its pathogenesis is as yet incompletely understood. Starling's classical concept, that physico-chemical alterations brought about by low plasma protein levels could explain oedema formation, is no longer considered as satisfactory. The importance of endocrines in water balance has been recognised in recent years, particularly the role of adrenocortical secretions and of the antidiuretic hormone (ADH). Several investigations reported from these laboratories have suggested that oedema of PCM is mediated through altered metabolism of ADH.

There have so far been, no studies on the actual levels of this hormone in circulation in subjects suffering from nutritional oedema. Levels of ADH in plasma and urine in children suffering from kwashiorkor at the height of oedema and after its disappearance were determined. Similar studies were done in children who were grossly marasmic but who did not have oedema.

Levels of ADH in plasma and urine of oedematous children were found to be significantly higher than in normal children, while in children with marasmus the levels were essentially normal. Following on the disappearance of oedema, levels of the hormone had returned to normal, thus providing direct evidence for an aetiological role for ADH in oedema of PCM.

4 PLASMA AMINO ACID PATTERNS IN
PRE-SCHOOL CHILDREN

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Serum amino acid profiles and rates of growth of pre-school children on vegetarian diet have been studied. A comparison of the amino acid patterns is made with children with protein-calorie malnutrition.

5. THYROID FUNCTION IN KWASHIORKOR

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As part of a study, designed to evaluate the endocrine alterations in protein-calorie malnutrition in children, the functional status of the thyroid gland in kwashiorkor was investigated. Thyroidal uptake of ^{131}I and plasma protein bound iodine (PBI) levels were determined in children suffering from kwashiorkor as well as in apparently normal children. The mean ^{131}I uptake in normal children was 10.8, 12.6 and 17.9% at 1, 2 and 24 hours respectively, after the oral administration of 5 μC . ^{131}I . The corresponding values in children with kwashiorkor were 13.0, 13.3 and 18.2%. There was no difference in the thyroidal ^{131}I uptake between the normal children and those with kwashiorkor.

The mean plasma PBI level in normal children was 6.2 $\mu\text{g}/100\text{ ml}$. Of the 22 kwashiorkor children investigated, the mean plasma PBI level in ten was 5.4 μg and this did not change after nutritional rehabilitation. In the rest, the levels were below 3.5 $\mu\text{g}/100\text{ ml}$. with a mean of 2.2 $\mu\text{g}/100\text{ ml}$. and the levels rose to normal after nutritional rehabilitation. The perchlorate discharge test was performed on 11 children. Five of these children had a positive response and the plasma PBI levels in all of them were below 3.5 $\mu\text{g}/100\text{ ml}$.

These results indicate that the uptake of ^{131}I by the thyroid is normal in kwashiorkor. However, 50% of the children had low plasma PBI levels associated with a positive perchlorate discharge test indicating a possible impairment of organification of iodide within the thyroid gland.

6. STUDIES OF ANTIBODY RESPONSE AND RATE OF MORTALITY IN HYPOPROTEINEMIC RATS

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The present work was designed to study some factors involving the complex interrelationship between nutrition and infection in experimental animals. It includes data on rats divided in different groups and kept on either a 16% or a 4% casein diet.

The antibody responses against known antigenic stimulus (*Salmonella typhimurium* with adjuvant) in the two groups of rats were compared during the 8 weeks period of observation. Different tests were performed to demonstrate the antibody response which consisted of agglutination reaction, tanned cell haemagglutination test, paper electrophoresis, gel electrophoresis and gel precipitation. Data showed decreased level of total protein and serum albumin, loss of weight and decreased level of haemoglobin and total W.B.C., in rats kept on protein deficient diet. But no significant difference in the antibody response in the protein depleted and the control group of rats was noticed.

Comparing the mortality rate in the two groups it was observed that there was increased rate of mortality in the protein depleted rats.

These experiments do not suggest that there is any correlation between ability to produce antibodies and resistance to fatal infection.

This experimental situation parallels that of children in developing countries and provides an animal model for further work.

7. ELECTROPHORETIC CHANGES IN THE FRACTIONS OF SOLUBLE LENS-PROTEINS IN PROTEIN-DEFICIENT RATS AND THE EFFECT OF REALIMENTATION WITH AN ADEQUATE DIET

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Changes in the proportions of the different fractions of the soluble proteins of the lens tissue have been observed in different types of cataracts, in man as well as in experimental animals. In view of the reported relationship between protein depletion and cataract formation in animals, this study was undertaken to determine, whether in protein-deficient rats, the pattern of the soluble lens-proteins show any change.

Rats were kept on 2%, 4% and 18% protein diets for 5 weeks and then killed, leaving a few rats in the 2% protein group for the refeeding experiment. These rats were put on an 18% protein diet for further 5 weeks and then sacrificed. Paper electrophoresis was done with the supernatant portions of the centrifuged lens-homogenates and the curves for the soluble fractions of the lens-protein, drawn by densitometry. The relative percentages of the different fractions were also measured colorimetrically after elution. In the rats on 2% and 4% protein diets, there was appreciable reduction in the proportion of *alpha* and *beta* crystallins and marked rise in the *gamma* crystallin fraction. On refeeding some rats of the 2% protein group with an 18% protein diet for further 5 weeks, the altered pattern of the soluble lens-proteins were almost restored to normal.

8. GLYCOGEN SYNTHESIS AND BREAKDOWN IN THE LIVERS OF CHILDREN WITH PROTEIN CALORIE UNDERNUTRITION

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Severe protein calorie undernutrition in children is associated with alterations in carbohydrate metabolism. The changes are more profound in kwashiorkor than in marasmus. The present investigations report observations on the synthesis and breakdown of glycogen by homogenates of the liver in kwashiorkor and marasmus. Results are compared with the data obtained after recovery of the children from the malnutrition. In kwashiorkor, the glycogen synthetase activity of the liver was approximately half to a third of the normal hepatic glycogen content in the same age period and the glycogen synthetase activity on admission was a third of the values obtained after recovery. In two severe cases of kwashiorkor the synthetase activity could not be demonstrated at all; both of them died within 48 hours of admission. The phosphorylase activity of the liver in kwashiorkor on admission was found not to be significantly different from the values obtained after recovery, but there was a reduction in glucose-6-phosphatase activity. In the two children who died of kwashiorkor both phosphorylase as well as glucose-6-phosphatase activities were found higher than normal. Only two cases of marasmus could be studied because of the limitations of biopsy materials that can be obtained by needle biopsy in marasmus. The synthetic and phosphorolytic activities were found within normal limits in these two children. These findings would be discussed in relation to sugar homeostasis in protein calorie undernutrition in children.

9. RESPONSE OF LIVER AMINOTRANSFERASES
TO PROTEIN LEVELS OF DIET IN RATS

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Earlier work has shown that the activity of L-aspartate 2 : oxoglutarate aminotransferase isoenzyme of liver supernatant was higher in groups of rats supplemented with pyridoxine. A similar effect of pyridoxine was now observed in livers of rats fed low levels of protein (6-8%). The activity of the mitochondrial L-aspartate 2 : oxoglutarate aminotransferase was found to be high in groups fed the higher level of protein. The addition of pyridoxine to the diet at the same protein level (16 or 8%) does not appear to have any effect on the levels of the mitochondrial isoenzyme. The activity of the hepatic L-alanine 2 : oxoglutarate aminotransferase was high when the diet at either protein level was supplemented with pyridoxine.

10. EFFECT OF LYSINE FORTIFICATION OF WHEAT ON CARBOHYDRATE METABOLISM IN RATS

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Impaired carbohydrate metabolism in protein deficiency has been described by several workers. While considerable work has been done on the effect of a quantitative deficiency of proteins on carbohydrate metabolism, comparatively little is known about the effect of a qualitative deficiency. In the present investigation, the effect of lysine fortification of wheat flour on carbohydrate metabolism has been studied in weanling albino rats fed for 8 weeks. Animals kept on unfortified wheat showed hypoglycemia and elevated liver glycogen as compared to casein control animals. On fortifying the diet with lysine the blood glucose level increased significantly from 36.81 to 50.21 (mg/100 ml) but it was still lower than that found in the casein group (58.73 mg/100 ml). The liver glycogen, however, decreased appreciably from 144.8 to 61.76 (mg/100 g. body-weight), a level comparable to that observed in the control group. The P. E. R. of the unfortified diet increased significantly from 1.253 to 1.826 on lysine fortification but did not come upto the P. E. R. 2.784 of the casein diet. These observations suggest that protein quality probably has a direct effect on carbohydrate metabolism. The low blood sugar level and increased hepatic glycogen observed in the animals fed on the wheat diet are possibly due to its poor protein quality and the tendency of these levels to approach near normal on lysine fortification, can be attributed to the subsequent improvement in protein quality of the wheat diet.

11. OXYGEN COST OF EPILEPTIC CONVULSION

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Epileptic convulsion is believed to be originated from the heightened excitability of cerebrospinal neuraxis resulting into transient loss of consciousness followed by generalised tonic and clonic twitchings of the body musculature and is associated with substantial increase in the oxygen uptake. In a series of study of oxygen consumption, CO_2 -output, metabolic rate, blood oxygen tension (pO_2) in experimentally epileptic cats at different phases of epileptic seizure with or without convulsive movements conducted in this laboratory, it has been demonstrated that the increased O_2 -consumption, metabolic rate accompanied by a fall of cerebral blood pO_2 are closely associated more with the enhanced energy requirements of the nerve tissue, rather than the muscles. Further, the concomitant increased CO_2 -output and its retention retarded the kinetics of oxidative metabolism of brain tissue thereby initiated the arrest of seizure activity. Comparative studies of O_2 consumption during seizure discharge induced by topical application of penicillin, systematic administration of pentylenetetrazol or strychnine in different preparations like intact, decerebrate and spinal conditions closely correlated with the above observation that excess oxygen utilization was entirely due to the demands of the neuronal substrates responsible for such hyper-excitable discharges and the increased muscular activity would have required an additional oxygen usage which ultimately helped in the subsidence of seizure discharges.

12. SERUM COPPER AND CERULOPLASMIN LEVELS IN MATERNAL AND CORD BLOOD

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Serum copper levels and serum ceruloplasmin values (P. P. D. Oxidase activity) were estimated in the maternal venous blood and corresponding cord blood of 18 women belonging to low socio-economic group and of 12 women belonging to the high income group.

In the high income group, the mean level of serum copper was $230.5 \pm 9.30 \mu\text{g}/100 \text{ ml.}$ as against the mean level of $223.6 \pm 7.37 \mu\text{g}/100 \text{ ml.}$ of the low income group. The mean ceruloplasmin values were $0.22 \pm 0.003 \text{ O. D}/100 \text{ ml.}$ and $0.20 \pm 0.010 \text{ O.D}/100 \text{ ml.}$ in the high and low income groups respectively. The difference in copper as well as ceruloplasmin levels between the two socio-economic groups was statistically not significant.

On the contrary, the mean levels of both copper and ceruloplasmin in the cord serum of the low income group were significantly lower. The mean value of copper in cord serum was $83.6 \pm 3.3 \mu\text{g}/100 \text{ ml.}$ in the high income group as against a mean of $43.9 \pm 2.27 \mu\text{g}/100 \text{ ml.}$ in the low income group. The mean ceruloplasmin values in cord serum were $0.07 \pm 0.005 \text{ O.D}/100 \text{ ml.}$ and $0.04 \pm 0.003 \text{ O.D}/100 \text{ ml.}$ in the high and low income groups, respectively. Since transplacental transfer of ceruloplasmin does not occur, the low ceruloplasmin values in the new born of the low income group might possibly reflect an impaired synthesis of ceruloplasmin by the liver at birth in that group.

A direct correlation between birth weight and cord ceruloplasmin value was observed ($r=0.57$, $P < 0.02$). The low levels of ceruloplasmin are suggestive of an effect of maternal malnutrition on the new born.

13. STUDIES ON MITOCHONDRIA OF MAGNESIUM DEFICIENT RATS

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Magnesium deficiency has been reported to cause reduced growth, neuromuscular and central nervous system changes, marked electrocardiographic changes etc., giving a suggestive evidence for the disbalance of energetics of the living cells and tissues.

The object of the present work was to elucidate certain molecular mechanisms involved in the action of magnesium in the energetics of living cells. Oxidative phosphorylation and swelling of mitochondria in presence of various reagents were studied in detail.

Magnesium deficiency was produced in rats, by feeding animals a low magnesium synthetic diet (2-4 mg %) and quadruple glass distilled water.

After 15-21 days, symptoms observed were poor growth, hyperemia and dazed appearance.

In the deficient animals P : O ratio was significantly lowered with both succinate and α - ketoglutarate, although oxidation rate remained same or slightly increased with succinate. Oxidation decreased in case of α - ketoglutarate accompanied by decreased phosphorylation. The effect was present in all the tissues taken. Magnesium content of the tissues was also significantly lowered.

Supplementation of magnesium to the diet resulted in restoring P : O ratio to normal values with both α - KG and succinate. Tissue magnesium also showed a tendency to return to normal levels.

1. THE KEY TO NUTRITION EDUCATION OF ILLITERATES

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Malnutrition abounds in every impoverished and illiterate community in Asia. Formal teaching methods will not influence this important group. Participation in practical nutrition programmes is the most effective way of teaching them.

The means of participation that are used at the Nutrition Education Unit of the C. S. I. Hospital, Jammalamadugu, Andhra Pradesh, India, are described :

1. *Maternal preparation of food for their malnourished children under supervision*: Mothers participate in preparing food and feeding their undernourished children back to full health using locally available commodities.
2. *Parent-retained weight cards with nutrition illustrations*: Parents are given the responsibility of keeping their children's weight cards and bringing them regularly for weighing. They are encouraged to keep the children's weight curves gaining upwards on "the road to health" by correct feeding.
3. *Parents rubber-stamp food pictures on a nutrition card to reinforce teaching and demonstration*: Parents milk their own pictures of the foods they have been taught about. Illustrations are rubber-stamped opposite appropriate pictures of the milestones of development of young children.

"If I hear, I forget.
If I see, I remember.
If I do, I know."

The message of the Chinese proverb is still important in all education, but it is vital in the education of illiterate mothers. More and different ways of participation must be devised.

2. TECHNIQUES IN RURAL NUTRITIONAL STUDIES

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Fresh medical graduates are stationed at one or the other Rural Health Training Centres, for a few weeks, as medical interns. In the absence of any orientation programme in field nutritional studies, they usually record Bitot's spots, angular stomatitis, dental caries, dry skin, etc., as signs of malnutrition, *without* verifying their dietary origin. Realising the importance of correlating food intake with clinical malnutrition, particularly in a set-up wherein even weighing machine may not always be available, the author regularly visits such R. H. T. Centres in Maharashtra and demonstrates to them the simple techniques as to how to suspect early nutritional disturbance in different situations, with just a few questions on foods, as available and purchased; as cooked and consumed. With the help of pre-standardised local household measures, reasonably reliable food consumption data of a family (or a school child) is obtained. It is accurate enough to enable an on-the-spot correlation with the nature and extent of malnutrition observed clinically by the 'doctor' trainees.

These rather painstaking field studies, spread over years, have helped the author interpret the nutritional significance of what is termed 'Clavicular' sign (for fat deficiency) as also the 'humerus' sign (for protein-calorie malnutrition). Further, it will be explained how this experience can be utilised in training the young, receptive 'doctors' in scientific assessment of nutriture.

3. THE SIGNIFICANCE OF NUTRITIONAL DATA IN
SOCIO-CULTURAL RESEARCH: EXAMPLES
FROM SOUTHERN INDIA

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This paper discusses findings from a recently completed medical anthropological research project in rural Tamilnadu, Southern India, which has utilized detailed nutritional and medical data for the elucidation of socio-cultural systems. Special attention is given to evidence indicating that analysis of behaviourally defined social groups regularly distributing and consuming foods (termed *alimentary groups*) permits better understanding of nutritional levels than does analysis of traditionally-studied named social groupings like family, household, kin, caste, or village. Indication is given of the varieties of membership that may be found in alimentary groups, the ways in which these groups cut across other social units, the kinds of foods which tend to be regularly distributed within the alimentary groups, and the measureable differences in nutritional level that relate to such memberships. Distinctions are noted between those nutritional values related to local socio-cultural contexts and those related to "outside" factors. Since development and supplementation programmes often require such data, closer consideration of the obtained quality is urged. Methods and foci of inquiry for improving the quality and relevance of socio-cultural data are discussed.

4. DAIRY MARKETING MODERNIZATION AS A MEANS OF NUTRITIONAL IMPROVEMENT

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It is gratifying to move from the 60's pre-occupation with avoiding starvation to the present wide-spread emphasis on nutrition. The problem of food shortage was relieved by concentrated food grains research and extension. These staple commodities met immediate needs and required relatively small investment in complimentary market development. Although nutritionists may specify improved diets, based on durable grains and pulses, developing country consumption expenditure data indicate improved diets will include large quantities of perishable commodities bearing increased marketing charges.

Improvement of perishables marketing and precessing poses transfer and adaptation problems, as did improvement of grain production technology. A pool of conference participants would likely reveal a preference for milk as a nutritionally important perishable. Sound reasons exist for dairy development, in the interest of consumers and agriculturalists. However, rapid transfer to India of marketing technology long established in developed countries resulted in exceedingly low labour productivity and return to investment in comparison to traditional marketing systems.

Inter-country variability in transferability poses difficulties for marketing as well as production technology. Milk products consumption preferences in the Middle East create a different challenge from the South Asian. Internationally coordinated research on marketing technology for nutritionally important perishables seems in order.

5. PROGRESS OF APPLIED NUTRITION PROJECT IN THAILAND

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In 1961 UNICEF, FAO, WHO, in collaboration with Ministries of Public Health, Agriculture, Education and Interior launched an action program "Applied Nutrition Project" in 10 villages of Ubol province, with the objective to combat malnutrition and to raise general nutritional levels of the people in rural area. The project area was expanded to 29 villages in 1964 and 2 villages in Chiangmai were also started in 1967. The pilot program dealt on a small scale with several aspects of applied nutrition, baseline and periodic survey, training, production of foods, including vegetable, poultry and fish at the schools, midwifery centers, and communities, nutrition education and also the evaluation of the project were included. The results of evaluation in 1966 showed only slight changes in the nutritional status, there was also an over all reduction in the signs of deficiency diseases as compared with the original figures.

In 1968 the Department of Health through the Division of Nutrition revised the whole methodology of the project, based on previous experience in ANP villages of Ubol and Chiangmai. New targets for action were set up, protein malnutrition was regarded as top priority problem while pre-school children became target population, pulses and poultry were emphasized. Production of new infrastructure needed in implementing the program was desired in the form of Child Nutrition Centre where children were collected and fed a meal at lunch time. Mother's education was another feature provided by the centre. Aiming to integrate nutrition activities at the village level with the program of rural health centres, nurses, midwives, food production aides and child care attendants were trained. Protein Food Development program are developed. At the end of December, 1970, 53 child nutrition centers have been organised in 26 provinces with the co-operation of local personnel.

6. APPLIED NUTRITION PROGRAMME AS MEDIA FOR MASS COMMUNICATION

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Applied Nutrition Programme is purely an educational one which aims at making rural people nutrition conscious by giving necessary incentive for producing more of protective foods, demonstrating the value of these foods through selected feeding centres, training concerned people and imparting nutrition education through group discussions, demonstrations etc.

This is implemented in most of the States in India and is in progress in 50 C.D. Blocks of Kerala, covering nearly 30% of the total area and 32% of the population. Most of the targets were achieved in 35 of the above Blocks where the programme was in existence for more than three years. There are more than 7000 home gardens, 350 school gardens, 23 community gardens, 350 poultry units, 34 mechanised fishing boats, and two milk-chilling plants now functioning. Through 1,111 feeding centres under various Mahila samithies more than a lakh of beneficiaries are given milk/CSM, eggs, fish, vegetables, etc., and these centres are utilised for nutrition education also. More than 4,000 people were trained in nutrition. It is proposed to conduct 10 women's camps in each block. Of these, 8 camps are now over in 8 blocks in which a follow-up study was made to find out how far the campers have put into practice what they studied at the camp. This reveals that in almost all families of the campers, home gardens have come up within two weeks after the camp. In 50% of the families small poultry units were started. Leafy vegetables, papaya, and groundnuts are given more importance in their daily diets than before, and improved methods of cooking were introduced in 25% of the families. In the distribution of protein rich foods (milk & eggs) preference is now given to the 0-4 year age group.

This clearly indicates that the programme is best suited as a media for mass communications.

7. TRAINING PROGRAMMES IN NUTRITION FOR MEDICAL PERSONNEL: EXPERIENCES AT THE NATIONAL INSTITUTE OF NUTRITION.

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The National Institute of Nutrition has been offering for the past eight years an advanced training programme in theory and practice of nutrition for medical graduates. The course covers work in the field, laboratory and the clinic. The objectives of the course are to provide appropriate nutrition orientation to senior public health workers and to teachers in the departments of paediatrics, social and preventive medicine, general medicine and other departments in medical schools. A programme leading to Master's degree in nutrition is also being offered for the past three years.

More than 70 participants from various South East Asian and Western Pacific countries and more than 90 participants from the various medical colleges in India have been trained in these courses which are supported by the W.H.O. and UNICEF. Apart from senior staff of National Institute of Nutrition, outstanding nutrition workers from abroad and India participate as guest lecturers in the courses.

These courses offer a forum for the mutual exchange of ideas among teachers in different specialities allied to nutrition and serve to expose the participants to the many modern techniques which will be useful in the field and in the hospital in the treatment and prevention of nutritional disorders. These courses have served to provide the necessary leadership among medical personnel for the implementation of public health nutrition programmes in many South East Asian countries.

8. NUTRITION EDUCATION IN HOME SCIENCE

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9. PUBLIC HEALTH NUTRITION

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Public health nutrition connotes protection and promotion of health through the manipulation of population, social organization due to modernization, limited resources, insufficient infrastructures, illiteracy and ignorance of the majority of the population.

Developments during the last two decades: in medical and training facilities, improved services, the achievements in eradication of communicable diseases and training of planners and administrators through National Institutes, are noted. Programmes like school-feeding, production of weaning and supplementary protein rich food, fortification of salt with iodine for eradication of goitre, the composite nutrition programme, are ameliorative steps. However, the hazards of malnutrition are: a yearly, 4 million blind children, possibilities of mental dwarfism in children, and maternal mortality of 30 to 40 per cent due to nutritional anaemia; are depressing. The national cost estimates of maintaining victims of malnutrition are higher than in preventive measures.

As public health nutrition is essentially developmental, involvement of beneficiaries and public co-operation is essential for accelerating change, especially, when gains are not immediately visible. The centralised programmes are less effective because of the logistics of distribution. Until decentralization is possible, available man power should be conscripted. Addition of home scientist to the primary health unit would augment the present domiciliary services. The voluntary N. S. S. should be compulsory during vacation on a remunerative basis, to undertake supervised programmes in public health nutrition. The budget could be supplemented by abolition of N. C. C. and utilization of its funds. The development of leadership among responsive young beneficiaries is an important strategy. Action research and built-in evaluation is an essential part of an effective programme.

10. NUTRITION TRAINING AT THE INSTITUTES OF CATERING TECHNOLOGY

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'Productivity through Nutrition' is the theme of result-orientated Nutrition Training in the Catering Institutes. The aim and scope of this programme are:

1. To develop an understanding that nutrition knowledge is dynamic and ever growing.
2. To establish habits of seeking reliable information.
3. To appreciate that food be consumed for nutritional benefits; to study tastes and develop skills and techniques so that food satisfied physical and psychological need and also provides nutrition.
4. To provide experience in the choice of foods for different age and socio-economic groups to ensure balanced feeding.
5. To bring about an awareness of the deficiency of diet in India brought about by ignorance and wrong feeding habits.
6. To develop a sense of responsibility for the improvement of nutrition on a national level and to understand and practise that elimination of waste at all levels bridges the gap between malnutrition and health.
7. To determine the different types of food commodities available in our country to meet our nutritional demands and to study the process each undergoes from farm to table.
8. To study the influence of cultural patterns on consumption of foods; how these patterns can be changed by motivation and education.
9. To diversify feeding habits by introducing new sources of food and develop acceptable recipes using these.
10. To understand that wholesome food also means safe food and to apply the principles of hygiene at all stages.

Although ambitious, these objectives can perhaps be achieved by an inter-disciplinary approach in the teaching of nutrition.

11. TRAINING OF DIETITICIANS IN INDIA

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12. NUTRITION EDUCATION IN RURAL INDIA
—CARE EXPERIMENT

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13. IMPACT OF NUTRITION ON DIETS IN RURAL AREAS

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Nutrition Education is given through Maternal Child Health & Family Planning Clinics, and also through regular home visits.

A diet survey was done in Berh village in February, 1967, and 24 Families co-operated. These were mainly cultivators. On analysis the following was found.

1. They consumed cereals, green leafy vegetables and roots and tubers in quantities much larger than required.
2. Protein foods were consumed in negligible amounts.

Nutrition Education was continued as before, but with special stress on protein foods, particularly the cheap ones i.e. pulses, bengal gram, ground nuts, peas & beans, eggs and Gugli (snails).

In June 1970 another survey was done in the same village 15 of the same families co-operating. 23 Families were surveyed in all.

It was found that:

1. The cereal consumption went up by 8% (these are cultivators and perhaps having better production with A.N.P. assistance. Also, cereals were cheaper in 1970 than in 1967).

2. Vegetables of all varieties were consumed in smaller quantities (probably because it was summer and Vegetables were not in such abundance as in winter). The consumption of Roots & tubers came down to normal requirement.

3. The consumption of protein foods however showed a spurt though, it was still very much below requirement. Dal consumption went up 10 times eggs 6 times.

14. MERKET AND NUTRITION ORIENTED FOOD HABITS STUDY IN WESTERN INDIA-SOME HIGHLIGHTS

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A food habit survey, sponsored by Proteins Foods Association of India, was conducted in a sample of 3000 families spread over 13 towns and 26 villages in two states of India.

The main objectives of the survey were to find out :

- i) the nutrient intake, by persons in the different age groups and socio-economic levels.
- ii) extent of awareness of nutrient value of different food items.
- iii) food items taken by children and adults in the different socio-economic groups.
- iv) taboos and preferences regarding food items and ingredients.

The main finding of the survey were :

- i) though the overall level of calorie intake is fairly close to the requirement, large gaps are seen in the intakes by children upto 12 years of age.
- ii) the protein intake is less satisfactory than calorie intake. The protein gap is maximum for weaning and pre-school children.
- iii) the calorie and protein gap exists even in the higher income brackets.
- iv) though people were aware of words like vitamin, protein and calories, they did not know specific significance of each of these, leave alone their associations with specific food items.
- v) while nursing mothers were aware that they need to take more protein foods, such awareness was lacking among the pregnant mothers.
- vi) solid food for weaning children was started much later than it ought to have been.

The survey results were helpful in developing a mass communication campaign recently launched by PFA.

15. A PILOT STUDY ON THE USE OF MASS COMMUNICATIONS MEDIA FOR NUTRITION EDUCATION

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The Protein Foods Association of India is conducting a one-year pilot study on nutrition mass communications in Maharashtra, to test many communications techniques, strategies and hypotheses in nutrition education. The objective of the campaign is primarily to bridge the information gap on nutrition in general and proteins in particular, and to motivate people to take corrective action.

The target audience for the campaign are the urban and semi-urban, with concentration on the lower and the middle income groups a practical solution to the conflict between vulnerability and reachability.

The message emphasizes the harmful effects, especially for children, caused by protein malnutrition and suggests practical solutions in terms of balancing the diets with inexpensive every-day foods.

The press, cinema, radio and outdoor hoardings are among the conventional media being used. Readership surveys and media habits research findings have been the basis of planning the media schedules to get the maximum reach among the target audience. Other non-conventional media like exhibitions etc. have been planned to improve the spread of the campaign.

Evaluative researches have been built into the project. A bench mark research has preceded the campaign establishing the pre-campaign awareness levels. A mid-campaign and a post-campaign research have been planned to measure shifts in awareness levels which will be the criterion for judging the success of the campaign. Projective techniques such as "Thematic Apperception Test" will be used for recording sampled audience responses. The differential of the awareness levels by message-source will enable a comparative media evaluation. The research findings will be the starting point for planning national extension of the campaign.

16. A CRITICAL STUDY OF 35 RESIDENTIAL
BHU STUDENTS MESSSES

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Out of 101 residential student's messes in the BHU township, 35 messes were studied. The components of the study were as hereunder :

1. In depth studies of the functioning of the three systems of mess management i. e. contract, private and co-operative through their respective dynamics of 'mess formation', 'marketing', 'menu making', 'diet preparation' and other day to day management factors including mess hygiene.
2. Seven days diet survey in all 35 messes by weighment method.
3. Analysis of the variations in the socio-economic, cultural (including diet habits) and geographical backgrounds of the members of the respective messes.

In the paper, an effort is made to outline the inter-relationships of the above-mentioned components with a view to evolve guidelines for Action Research methodologies for effective improvements of BHU Students' Nutrition within their respective socio-economic and cultural circumstances.

1. STUDIES ON NUTRITIONAL ANAEMIA IN THAI CHILDREN : THE EFFECT OF IRON SUPPLEMENT ON RED CELL HAEMOGLOBIN AND GROWTH OF PRE-SCHOOL CHILDREN

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Haemoglobin, packed cell volume (P. C. V.) and subsequently mean corpuscular haemoglobin concentration (M. C. H. C.) were determined for pre-school children (128 children) in 2 villages, Resettlement Village 14 and Non Bua Noy, in the Northeast of Thailand. The incidence of anaemia was high in children from both villages. The combination of low haemoglobin values below 30 suggesting iron-deficiency anaemia. This possibility was further investigated in a supplementation experiment carried out on the pre-school children in village 14 (48 children).

The children were divided arbitrarily into two groups. One group received iron as ferrous sulphate, 10 mg. per kg. per day, in a mixture containing 10 mg. ferrous iron per ml. The control group received the same mixture, containing only preservative, flavourings, etc. but no iron. The mixture was given for a period of three to four months.

There was a significant increase ($P=0.001$) in the blood haemoglobin level of the children receiving the iron supplement. The increase in M.C.H.C. values was also significant ($P=0.001$) but P.C.V. values were not influenced by the iron supplements. In the control group, the small rise in blood haemoglobin and M.C.H.C. were not significant.

Height and weight measurements were also examined to see whether iron supplementation stimulated growth of the children. Their height and weight were measured each month during the period of supplement and also during the following six months. Iron supplementation had no significant stimulatory effect on either height or weight.

Similar studies are being carried out in children from a Bangkok orphanage and the dietary intake is being studied at the same time.

2. EFFECT OF DIETARY SUPPLEMENTS ON BIRTH WEIGHTS OF INFANTS

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The nutritional status of the mother is known to modify the course and outcome of pregnancy. The birth weights of infants born to mothers belonging to the poor income groups who subsist on inadequate diets are known to be lower than those of infants born to well nourished mothers. The influence of dietary supplements, given to expectant mothers during the last four to six weeks of pregnancy as also the effects of folic acid supplements given during the last 100 days of pregnancy on the nutritional status of the infants are reported here.

Improving the diets so as to provide 60 g. protein and 2500 kcal day during the last six weeks of pregnancy resulted in significant increase not only in the birth-weight of infants, but also their serum albumin concentrations. It also brought about a greater gain in maternal weight, a rise in serum albumin and increased excretion of oestrogen in urine.

The birth weights of infants born to mothers who had received folic acid supplements in addition to iron during the last 100 days of pregnancy was significantly higher than the birth weights of infants born to mothers who had not received such folic acid supplements.

3. GROWTH OF LOW BIRTH WEIGHT BABIES

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Three hundred and seventyfour babies weighing 2000 gram or less have been studied to evaluate their growth through the first two years of life. As far as possible, factors likely to affect the growth like birth anoxia, intracranial haemorrhage, neonatal morbidity, major congenital malformation, hyperbilirubinaemia, hypoglycemia etc. have been excluded. The babies have been divided into 1) those weighing upto 1500 grams and 2) between 1501 and 2000 grams. These have been further subdivided into premature and small for dates babies. An attempt has been made to show the difference between the premature and small for date babies by bringing the premature babies to "term" (40 weeks gestation) as the starting point and assess intrauterine and extrauterine growth as a continuous parameter.

4. EFFECT OF PROTEIN DEFICIENCY ON PATHOLOGY OF MITE INFESTATION OF LUNGS IN MONKEYS

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Monkeys (*M. mullata*) are known to frequently suffer from infestation of lungs by mites in their natural habitat. A study was undertaken to determine the influence of the level of dietary protein on the course of the illness, and the pathology of the lung in such animals.

Forty six adult monkeys known to be harbouring the mite were divided into two groups, and maintained on either adequate (16%) or low (4%) protein diets for a period of 100 weeks. A large number of monkeys on the low protein diet either died or had to be sacrificed when moribund before the end of the experimental period. Animals on the adequate protein diet remained apparently healthy till the experiment was terminated at 100 weeks. Complete autopsies were performed on all animals and the organs examined for gross and histological changes.

The organ which was mainly and consistently infested by the mites was the lung. The essential pathology in the organ was bronchiectatic lesions. Striking differences were found not only in the degree and extent of lung damage but also in the type of cellular response to the parasite in the ectatic bronchi, between the animals of the two groups. A detailed account of the changes seen in the lungs will be presented and their significance discussed.

5. RENAL AND HEPATIC HISTOPATHOLOGY IN MALNOURISHED INFANTS AND CHILDREN

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The present study has been carried on 252 cases of malnutrition. The maximum incidence of the disease was in the age group of 6 months to 2 years. The etiological factors responsible were inadequate diet, gastrointestinal, pulmonary and skin infections. Anaemia was present in 91% cases while hypoproteinaemia in 68.5% cases.

Liver function tests were deranged in 70 - 75% cases and liver biopsy in 110 cases revealed various histopathological changes.

Regarding renal functions, urinary findings were present in 23% cases and electrolytes were disturbed in 40% cases. Renal biopsy was done in 110 cases. Histology was normal in 5 cases only. In the remaining 105 cases different histopathological lesions were detected. The correlation of histopathological changes and biochemical disturbances will be discussed.

6. THE POSSIBLE CORRELATION BETWEEN
THIAMINASE ENZYME
AND BERIBERI IN THAILAND

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Approximately 1300 units of thiaminase enzyme extracted from raw clams (*Paphia* sp.) can cause thiamine deficiency in rats when given orally, as measured by whole blood transketolase activity. The addition of thiamine pyrophosphate (TPP) to blood hemolysate of thiamine deficient animals resulted in a significant enhancement in transketolase activity and the effect progressively increased as the deficiency became more severe. The degree of stimulation of TPP added *in vitro* was not observed in the hemolysate of control animals. The result of this study indicates that thiaminase in fermented fish, which was found to be similar to that extracted from raw clams, can also cause thiamine deficiency. Thai people who live in the Northern and North Eastern parts of the country consumed a large amount (approximately 56 gm) of raw fermented fish in their daily diet. This amount of fermented fish is equivalent to 25 units of enzyme per day. A repeated consumption of this food material throughout their lives could certainly lead to a state of thiamine deficiency.

7. ERYTHROCYTE TRANSAMINASE ACTIVITY IN HUMAN VITAMIN B₆ DEFICIENCY

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Signs of riboflavin deficiency like cheilosis, glossitis and angular stomatitis are frequently seen among the poorer sections of our population. It is however, seen that not all subjects with these manifestations fully respond to therapy with riboflavin alone; but need other B-complex vitamins, specially vitamin B₆. Experimentally induced pyridoxine deficiency is known to produce signs similar to those of riboflavin deficiency. The pyridoxine nutritional status of population groups among whom angular stomatitis and glossitis are common was therefore investigated, employing transaminase activity in the erythrocytes as a biochemical parameter. Both the basal levels of EGOT and its stimulation *in vitro* by addition of pyridoxal-5-phosphate as parameters were determined in normal subjects belonging to both the high and low income groups, in pregnant subjects and in pellagrins.

The results indicated that the enzyme activity in subjects of low socio-economic groups was significantly lower than that of the high socio-economic group. One third of the pellagrins investigated had low basal activity with increased *in vitro* stimulation. In the other pellagrins who had signs of concomitant deficiencies of other B-complex vitamins, particularly riboflavin, the transaminase activity was high. Similar trends were also seen in pregnant women and adult men with oral lesions suggesting that riboflavin deficiency may lead to increased levels of transaminase activity. The results of these studies provide biochemical evidence for Vitamin B₆ deficiency in apparently normal population groups and also indicate that signs attributable to riboflavin deficiency are similar to those of Vitamin B₆ deficiency. These results also suggest that the level of transaminase activity in the red cell may be modified by riboflavin nutritional status.

8. THE INCIDENCE OF PROTEIN-CALORIE DEFICIENCY IN INDONESIA

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Protein-Calorie Deficiency is prevalent in many developing countries. Basically the cause is the same—insufficient protein and calories to meet the requirements of the body.

However, its background, epidemiology, ecology and its manifestations differ from country to country.

In Indonesia Protein-Calorie Deficiency is considered one of the main nutrition problems.

It is found in various manifestations in the different age groups.

The incidence in the infant and toddler will be focused.

Early symptoms of Protein-Calorie Deficiency appear at approximately the age of 6 months. While full blown marasmus, kwashiorkor or marasmic kwashiorkor cases are found after the child is over one year of age. Various factors are responsible for this clinical picture—from food production down to menu pattern, food habits, food utilisation, and environmental sanitation.

9. NUTRITION, INTELLECTUAL ABILITY AND
NATIONAL DEVELOPMENT

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10. SCHOOL LUNCH PROGRAMMES IN THAILAND

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11. NUTRITIONAL ANTHROPOMETRIC STUDY OF
WHITE COLLARED PUNJABIS AT SIMLA

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The mean values and standard deviations of height, weight, bicristal diameter, upper arm girth and wrist girth of 210 Panjabi speaking Hindu "Khatri" (an endogamous caste) clerks aged 20-55 years living at the hill station of Simla are presented. The mean values of these measurements are compared with the corresponding measurements of the people of the same cocupation, caste and income group living in the plains (Delhi). Correlation matrix between the 5 variables is also presented.

Mean values of body weight and arm girth measurements of Simla subjects were significantly lower than those of Delhi subjects.

Correlation coefficient between arm girth and body weight was highest of all the correlations.

12. NUTRITION REHABILITATION : LIMITING FACTORS IN RURAL SOUTH INDIA

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An account is given of nutrition rehabilitation in a parent orientated programme where mothers participate in preparing food and feeding their malnourished children back to health using primarily locally available commodities.

The most important aspect of this educational experience is for mothers to see their own children returning to health on a diet they have prepared and fed them. It includes active co-operation in careful marketing, cooking the food, and helping with the kitchen garden. Simple instruction is given in organising a suitable diet, home management, child care and family planning.

Fifty children with protein-calorie deficiency syndromes who were admitted to the Nutrition Education Unit of the C.S.I. Hospital, Jammalamadugu, in a drought affected area of rural Andhra Pradesh, were studied and followed up. This reveals that the educational impact of the work is limited by:

1. Many medical complications of the malnutrition.
2. The severity of the condition before parents agree for admission. These two factors necessitated intensive medical treatment.
3. Poverty, a diet of adequate quality and quantity could not be given at home.
4. Inability of mothers to stay in hospital long enough to see their children completely better and the nutritional lesson firmly established.
5. Habituation of the family to restricted diet and cooking pattern, due to social custom and economic stress.
6. Food fads and falacies.
7. Practical difficulties in cultivating kitchen gardens.

Suggestions are made as to how some of these difficulties can be overcome.

13. NUTRITIONAL HEALTH IN A CHANGING
SOCIETY—STUDIES FROM ISRAEL

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Two trends of development have imprinted their marks on the nutritional health of the population of Israel during the last 20 years: a large immigration from technologically less developed countries, and a rapid progress in agricultural and industrial production. There has been an increase in the per capita consumption of meat, poultry, eggs, oils and fats, sugar and fruit, with an increase in intake of calories and animal protein. The acculturation of different communities has been intensive, with a rapid change in the food habits, as evinced from studies among immigrants from Yemen and Cochin.

At present, specific nutritional deficiency disorders, including protein-calorie malnutrition, are practically non-existent in Israel. Marginal forms of malnutrition are found, especially among children and pregnant women of low socio-economic status. This malnutrition is reflected in mild anemia, impaired growth and development, and mild clinical signs and biochemical abnormalities. Obesity, as a risk factor in the development of ischemic heart disease, is an important public health nutrition problem; morbidity and mortality from ischemic heart disease have increased markedly in Israel in recent years.

14. PHYTATE CONTENT OF IRANIAN BREAD AND ITS POSSIBLE RELATIONSHIP TO HUMAN ZINC DEFICIENCY

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The syndrome of impaired growth, hypogonadism and low plasma zinc concentrations occurs only in rural populations in Iran despite a close similarity of village diets to those of urban poor (Maleki, 1970). Together with other evidence, this suggests that the village environment includes factors that impair zinc nutrition. It is postulated that these may have their origin in village breadmaking methods, particularly the omission of leaven or short duration of fermentation when leaven is used. The result should be the survival in bread of most of the phytate present in the largely whole meal flours used. Phytate complexes zinc and so decreases its availability for absorption from the gastrointestinal tract. Phytate contents of breads from village and urban sources are being examined. The relationship between phytate contents and breadmaking methods will be described.

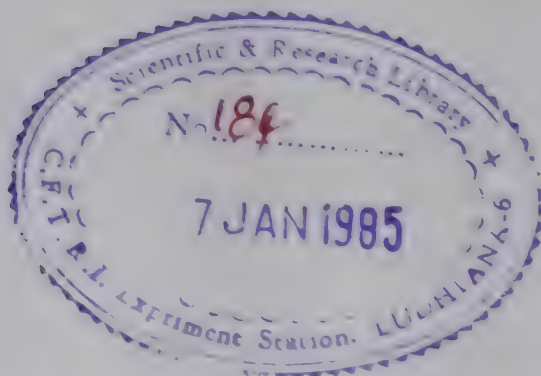
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